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Gazette

David Yost and Sid Morris (Editors)

Gazette of AustMS, CIAO,
Federation University Australia, PO Box 663,
Ballarat, VIC 3353, Australia

Eileen Dallwitz (Production Editor)

E-mail: gazette@austms.org.au
Web: www.austms.org.au/gazette
Tel: +61 3 5327 9086

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- Reviews of books, particularly by Australian authors, or books of wide interest
- Classroom notes on presenting mathematics in an elegant way
- Items relevant to mathematics education
- Letters on relevant topical issues
- Information on conferences, particularly those held in Australasia and the region
- Information on recent major mathematical achievements
- Reports on the business and activities of the Society
- Staff changes and visitors in mathematics departments
- News of members of the Australian Mathematical Society

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Deadlines for the *Gazette* are 1 February for No. 1 (March), 1 April for No. 2 (May), 1 June for No. 3 (July), 1 August for No. 4 (September), and 1 October for No. 5 (November).

For more information, visit www.austms.org.au/gazette.

- 250 Editorial
Sid Morris
- 254 President's Column
Jacqui Ramagge
- 257 Puzzle Corner 60
Peter M. Higgins
- 260 Talking Teaching
Edited by Diane Donovan, Birgit Loch and Sid Morris
- 262 Prime Minister's Prize for Science
- 263 Inaugural Riemann Prize
- 264 2019 ANZIAM Awards
- 271 Higher Degrees and Honours Bachelor Degrees in Mathematics and Statistics Completed in Australia in 2018
Peter Johnston
- 278 Equity, Diversity and Inclusion Committee, 2019 Report
Nalini Joshi
- 281 AMSI-AustMS Workshop Subfactors in Sydney
Arnaud Brothier, Pinhas Grossman and Susannah Waters
- 283 Workshop on Applications of Nonlinear Diffusion Equations
Bronwyn Hajek, Dimetre Triadis and Rebecca Chisholm
- 285 The n -matchstick challenge accepted
James East
- 288 AMSI News
Tim Brown
- 297 Mathematical Research Institute MATRIX
David Wood
- 300 SMRI News
Anthony Henderson
- 306 News
- 318 AustMS



Editorial

David and I welcome you to the last issue of the *Gazette* of the Australian Mathematical Society for 2019.

I begin by mentioning the recognition of a wonderful Australian mathematician—Emeritus Professor **Cheryl Praeger** AM, FAA. She was recently awarded the **Prime Minister's Prize for Science**. Australia has quite a number of male and female, young and not-so-young, mathematicians who have been recognized by their peers in Australia and around the world. But it is a special honour for an Australian mathematician to be awarded the Australian Prime Minister's Prize for Science. Cheryl modestly says that it is a recognition of mathematics in Australia. I have had the pleasure of knowing and respecting Cheryl for over 50 years and regard her as a first class ambassador for Australian mathematics and someone who has contributed so much, including as President of the Australian Mathematical Society. I should also add that The Age newspaper Giant Crossword on November 24, 2019 had the following clue to 6 Down: Which mathematician, renowned for her research in algebraic graph theory and associated fields, won the 2019 Prime Minister's Prize for Science? (6,7). Congratulations to Cheryl.

Congratulations also go to Professor **Terence Tao**, a graduate of Flinders University and Princeton University, who is now based at the University of California in Los Angeles. Terry was a winner of a Fields Medal in 2006 and a Breakthrough Prize in Mathematics in 2014. It was recently announced that he will be the inaugural winner in 2020 of the **Riemann Prize**. The prize, a work of art, will be awarded at a ceremony which is the culmination of week-long activities in honour of the awardee, a research conference and a mathematical festival at the Università degli Studi dell'Insubria in Varese, Italy.

Each issue of the *Gazette* has one of more puzzles in what we call *Puzzle Corner*. These have been prepared in recent times by Professor **Peter Higgins**. At the suggestion of Professor **Kate Smith-Miles**, the previous President of the Australian Mathematical Society, this year we have invited readers to submit their solutions. Peter is assisted in judging the submitted solutions by **Elizabeth Bradford** and **Alex Bishop**. Thanks to Peter and Elizabeth and Alex. This issue submitted solutions by Dr **Graham Baird** and Professor **Neville de Mestre** are discussed.

In our regular column *Talking Teaching* I discuss the use of ATAR alone as a mechanism for selecting those suitable to be future high school mathematics teachers. I recently attended the 55th year reunion of my high school graduation class at Cavendish Road State High School in Brisbane. This caused me to reflect on how I had been influenced very positively by my high school mathematics teachers.

In *AMSI News* **Tim Brown**, the AMSI Director, says that “The Australian Mathematical Sciences Institute (AMSI) has, as always, been working hard to champion the mathematical sciences in Australia. We aim, not only to strengthen public

engagement with mathematics in general, but also to explicitly foster and promote the wealth of skills, knowledge and diversity that women and girls bring to STEM... with 1137 media stories this year and an audience reach of 500 million, the Marketing and Communications team's hard work continued and campaigning led to two major awards. AMSI won the Best of the Best Award from Universities Australia for the Best Marketing Campaign on a small budget for their APR Intern 'Open Up Your World' campaign. Following this the social media app, Snapchat, also gave a campaign of the month award to Choose Maths with the filter engagement time being twice as long as the average."

Nalini Joshi reports in this issue of the recently established **Equity, Diversity and Inclusion Committee** of the Australian Mathematical Society. She describes the major activities of this Committee. All members of AustMS are encouraged to read her report as it contains information of importance.

In her President's Column, Professor **Jaqui Ramagge** warmly congratulates **Cheryl Praeger** on her receiving the Prime Minister's Prize for Science. Jacqui also discusses her serious concerns about politics impacting on the announcement of ARC Discovery winners.

In the article on 2019 ANZIAM awards we record the winners of these awards: Professor **Peter Taylor** won the most prestigious ANZIAM award, the **ANZIAM Medal**; Professor **Scott McCue** won the **EO Tuck Medal**; Professor **Ryan Loxton** won the J.H. Michell Medal.

As he does each year, **Peter Johnston** presents his report *Higher Degrees and Honours Bachelor Degrees in Mathematics and Statistics Completed in Australia in 2018*. In so doing Peter does a very important service to the Australian mathematics community. These reports have been produced for the last 25 years. The report "shows that in 2018 the number of Honours completions has again increased slightly over the previous two years and is slowly approaching the high numbers of completions in the years prior to that. The figure also shows the numbers of male and female students who completed Honours over the same time period. Last year, there was again a small increase in the number of male students with 136 completions (compared to 127 in 2017 and 124 in 2016), with the number of female students also increasing, up to 48 (compared to 44 in 2017 and 36 in 2016).

In the 2016 edition of this *Gazette*, Professor **Neville de Mestre** described the n -matchstick challenge. In this issue Dr **James East** of Western Sydney University replies with his article *The n -matchstick challenge accepted*.

In *MATRIX News* **David Wood** reports on the activities of the Mathematical Research Institute (MATRIX). It has recently hosted research programs in PDEs, Functional Data, Representation Theory, Topology, Differential Geometry, Number Theory, Models of Infectious Diseases, Ergodic Theory, Spatial Statistics, Physiological Rhythms, and Conservation Laws. The mix of programs from across the mathematical sciences that MATRIX will run in the coming year is listed. There is also mention of MATRIX Annals. The 2017 MATRIX Annals, the second volume in the MATRIX Book Series, is now published. The 2018 MATRIX Annals is almost complete. These books document scientific activities at MATRIX. The

Editors are **David Wood** (Editor-in-chief), **Jan de Gier**, **Cheryl Praeger**, and **Terence Tao**. Articles can be peer-reviewed, containing original results or reviews on a topic related to the program, or non-peer-reviewed expository articles based on talks or activities at MATRIX.

Anthony Henderson reports on the first year since establishment of the **Sydney Mathematical Research Institute** (SMRI). SMRI Director **Geordie Williamson** passed another milestone of his own, becoming the first mathematician working at an Australian university to speak in the prestigious annual ‘Current Developments in Mathematics’ conference at Harvard University. “By the end of 2019, that is, in the first eight months of our operations, SMRI will have hosted 22 visiting researchers funded through our International Visitor Program, as well as over 40 other mathematical scientists who were in Sydney for different reasons and generally for shorter periods.” Applications are currently being received for the fourth round of the International Visitor Program, with a deadline of 27 January 2020, which is for visits taking place in the period October 2020 to June 2021. See the website <https://sydney.edu.au/smri> for the terms and conditions and the application form.

In this issue there is also a report on the AMSI-AustMS Workshop Subfactors in Sydney held at UNSW Sydney, 4–8 February 2019 and the Workshop on Applications of Nonlinear Diffusion Equations held at La Trobe University, City Campus, 19–21 June 2019.

Finally, I mention the News section which has a wealth of information about comings and goings, completed PhDs, awards and other achievements, and forthcoming workshops, conferences and visitors. In particular, the following item is of particular interest: The ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS) is proud to announce the release of Season 2 of its podcast, The Random Sample. The aim of The Random Sample is to open up the world of the mathematical sciences to a whole new audience by showcasing interesting maths and stats research, as well as exploring issues of importance.

The first four episodes for Season 2 are available:

- “Matilda to the rescue”: Professor Kate Smith-Miles talks about the issue of trust when it comes to algorithms, and what her team has created to really ‘stress-test’ algorithms.
- “Weighing up evidence in criminal courts and at a king’s burial site”: Professor David Balding explores the use of statistical genetics in the legal system, and in identifying the remains of a medieval king.
- “MARVEL-lous casting”: Professor Matt Roughan shows how he’s using maths to help explain the popularity of the Marvel Comics Universe.
- “A day can make a difference”: Dr Amie Albrecht, Dr Melissa Humphries, and Dr Rachael Quill talk about the successful “Women In Maths” Day event held in Australia this year. What has come of it, and what’s ahead when it comes to the issue of gender equity in the mathematical sciences.

You can subscribe for free to the podcast by searching for “The Random Sample” wherever you get your podcasts. New episodes will come out on Wednesdays. To find out more about The Random Sample, head to the ACEMS website: ACEMS.org.au/podcast.

Finally, we need to be aware that work stress is growing and making time to have a break from it is essential for good mental and physical health. David and I wish you all the very best for over the summer break and for 2020.

Sid Morris, Adjunct Professor, La Trobe University;
Emeritus Professor, Federation University Australia.
Email: morris.sidney@gmail.com



Sid Morris retired after 40 years as an academic. He received BSc (Hons) from UQ in 1969 and PhD from Flinders in 1970. He held positions of Professor, Department Head, Dean, Deputy Vice-Chancellor, CAO and CEO. He was employed by the universities: Adelaide, Ballarat, Flinders, Florida, La Trobe, UNE, UNSW, UQ, UniSA, Tel-Aviv, Tulane, Wales, and Wollongong. He was Editor of *Bull. AustMS* and *J. Research and Practice in IT*, and founding Editor of *AustMS Lecture Series* and *J. Group Theory*. He has been on the Council of AustMS for 25 years and its Vice-President. He received the Lester R. Ford Award from the MAA. He has published 160 journal papers and 4 books for undergrads, postgrads and researchers, plus an online book, translated into 8 languages and supplemented by YouTube videos and a Facebook group of 8,000 members. In 2016 he was ordained as a Rabbi and in 2019 he edited the book: *Topological Groups: Advances, Surveys and Open Questions*. He enjoys spending time with his two grandchildren.



President's Column

Jacqui Ramagge*

As I signed off from my last report I encouraged everyone to look after each other and celebrate colleagues' successes by nominating them for prizes and awards. As an indication of the wonderful things that can happen, I am delighted to report that Emeritus Professor Cheryl Praeger AM FAA was awarded the 2019 Prime Minister's Prize for Science. This is the first time a mathematician has received the prize. It is a wonderful and appropriate recognition of Cheryl's achievements both in mathematics and beyond. Cheryl was the second female Professor of Mathematics in Australia, 20 years after the appointment of Professor Hannah Neumann at the ANU. Cheryl was the first Australian to serve on the IMU Executive Committee and is one of the country's most well-known and respected mathematicians. The prize is very well-deserved and helps to focus attention on mathematics as well as on Cheryl. See <https://www.abc.net.au/news/science/2019-10-17/2019-prime-ministers-science-prizes-cheryl-praeger-venetoclax/11608390> for more information.

Also in the limelight has been Payne-Scott Professor Nalini Joshi FAAS. Nalini has been elected a Bragg Fellow of the Royal Society of Australia and awarded this year's NSW Premier's Prize for Excellence in Mathematics, Earth Sciences, Chemistry, or Physics. Nalini was the first female Professor of Mathematics at the University of Sydney and is the first Australian to serve as Vice-President of the IMU. As well as her international renown for her work on Painlevé equations, Nalini was the cofounder of the Science in Australia Gender Equity (SAGE) program run by the Australian Academy of Science that sees Australian universities apply for Athena Swan awards. See <https://www.chiefscientist.nsw.gov.au/premiersprizes/2019-category-winners> for more information on the NSW Premier's prize.

On a less happy note, I am concerned at the increased politicisation of research funding outcomes. The process for determining and announcing the Australian Research Council (ARC) outcomes involves: the ARC CEO making a recommendation to the Minister for Education as to which applications should be funded on the basis of advice from experts; the Minister considering the recommendations and determining which applications will be funded; then the Minister announcing the funding outcomes. It used to be that the third step followed hot on the heels from the second step, to the extent that we never used to distinguish between the two events. The ARC would release results to Research Offices around the country as soon as the results were signed off under strict embargo so as to enable universities to prepare media releases which would then be posted as soon as the Minister made the announcement. Research Offices would not notify candidates until after the outcomes had been officially announced.

*Email: President@austms.org.au

This year has seen a disturbing change to that process, whereby the Minister has been signing off on outcomes but waiting several weeks to announce them. At first it seemed as if there was just a delay. Then the Discovery Early Career Awards (DECRA) were announced region by region over a period of 11 days. Only government MPs were invited to announce the awards even when the sitting local member was not a government MP, and it became clear that the announcements were being used to achieve political goals.

At this point we have no idea when the Discovery Project outcomes will be officially announced. Universities have taken matters into their own hands and decided to inform applicants of the outcome, imposing an embargo on them. The ARC now has several pages on its website dedicated to how embargo periods will be managed and what universities are allowed to do during the embargo period. In essence, universities can inform applicants of the outcomes but must not publicise them in any way. This includes not posting on social media or web pages and not advertising any positions associated to the grant.

Aside from the issue of using research outcomes for political purposes, I am concerned about the impact the delay in announcements will have on personnel and hence on the mathematical sciences in Australia. The northern hemisphere hiring season has already been running for two months and ends around February. The longer we have to wait to advertise postdoctoral positions associated to Discovery Projects the more likely it is that the candidates we most want to attract will have found positions elsewhere. The delay in the announcement of the DECRA meant that many applicants did not know in November 2019 whether they would have an income in January 2020. As it turns out, 11 of the 14 DECRA funded in the Mathematical Sciences already had ongoing positions at institutions in Australia. On the one hand, the combination of that data with the late notification of outcomes makes it really hard to build national capacity in the mathematical sciences by attracting international applicants who don't currently live in Australia. On the other hand, it means that we have been making excellent early-career appointments across the country in recent years.

Returning to a more positive note, you may recall that we have established an Equity, Diversity, and Inclusion Committee. It has made a number of recommendations to the Society, including that we establish an EDI lecture at our annual meeting. This can either be a mathematical presentation by someone from an underrepresented group, a talk celebrating the achievements of a mathematician from an under-represented group, or a talk on equity issues and challenges faced by members and the broader mathematical community. The inaugural lecture will take place at the 2020 AustMS meeting, and I very much look forward to it.

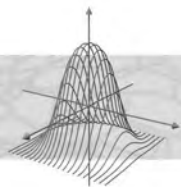
Finally, I hope that everybody takes a well-earned break at some point over summer¹. Remember that work never ends, so we have to learn to just stop doing it for a while in order to take a break. I look forward to being in touch again next year.



Jacqui Ramagge is a Fellow of the Australian Mathematical Society with research interests across algebra, analysis, and geometry. She is currently Head of the School of Mathematics and Statistics at the University of Sydney.

Jacqui has won awards for: teaching from the University of Newcastle; research environment from the University of Wollongong; and contributions to mathematics enrichment from the Australian Mathematics Trust. She has served on various Australian Research Council panels for eight of the last ten years including as Chair of the Australian Laureates Selection Advisory Committee. Jacqui is Chair of the Advisory Board for the University of Sydney Mathematical Research Institute and serves on the MATRIX Advisory Board.

¹Apologies to those members in the northern hemisphere.



Puzzle Corner

Peter M. Higgins*

Welcome to Puzzle Corner 60 of the *Gazette* of the Australian Mathematical Society. In this first section I will introduce three new problems: “More than one way to skin a mathematical cat”. After that I will give a solution to Puzzle Corner 59 on “Sam Loyd’s ferry boat rides again”.

I would be happy to receive your solutions to Puzzle Corner 60 not later than 31 December 2019. The email address for solutions is austmspuzzles@gmail.com. Any particularly interesting solutions will be mentioned in the next Puzzle Corner.

We are often assured as to the multiplicity of ways of cat skinning. At the same time we are never told what these ways are or why you would ever want to do such an awful thing in the first place. All the same, the metaphor is apt when it comes to this month’s little puzzle, which is to find the value of

$$\arctan 1 + \arctan 2 + \arctan 3. \quad (1)$$

This is a very nice problem for your students as there are three elementary but quite different techniques that can be brought to bear to answer the question. What is more, none of these approaches is particularly tricky or unnatural, at least not once they are pointed out to you. The first is perhaps the one most likely to occur to a student.

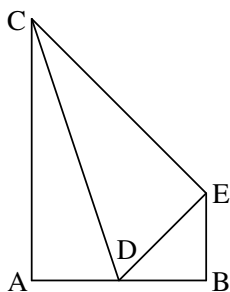
Problem 1. Find the value of the sum (1) by applying a suitable trigonometric identity.

On the other hand, you might need a minute to think about the next method but will be rewarded with a very quick solution.

Problem 2. Simplify (1) by taking the product of three judiciously chosen complex numbers.

And of course there has to be a straight geometric solution.

Problem 3. Solve the problem using Pythagoras through reference to the following picture.



*Email: peteh@essex.ac.uk

Solutions

Problem 1. The first time the boats pass, the *combined* distance they have travelled equals w , the width of the river. At their second meeting, their combined distance travelled equals $3w$. The ferry that had travelled 720 yards at their first meeting has therefore travelled $3 \times 720 = 2160$ yards when they meet for the second time. As this boat has also travelled $w + 400$ yards we obtain $w + 400 = 2160$, so that the width of the river is $2160 - 400 = 1760$ yards. Sam Loyd's river was one mile wide.

The changeover periods, although not simultaneous, were of equal duration so the key observation that on their second meeting each ferry had travelled three times as far as it had when they first met does apply. This is because the total distance has tripled and we are assuming that the boats are moving at constant (albeit different) speeds.

Problem 2. Let's work more generally and use a little more algebra, putting a and b to stand for the respective distances from the left and right banks (as we shall call them) at first and second crossovers. Let u be the speed of the ferry that initially departs from the left bank, and let v be the speed of the second vessel. If we let t denote the time of the first meeting, we have the equations $a = ut$, $w - a = vt$. Eliminating t between these equations then gives:

$$\frac{a}{u} = \frac{w - a}{v} \Rightarrow \frac{a}{w - a} = \frac{u}{v}.$$

Letting t now denote the time of the second meeting (ignoring the inconsequential changeovers) we get $w + b = ut$ and $2w - b = vt$ and so

$$\frac{w + b}{u} = \frac{2w - b}{v} \Rightarrow \frac{w + b}{2w - b} = \frac{u}{v}.$$

Equating the two expressions for $\frac{u}{v}$ now gives

$$\begin{aligned} \frac{a}{w - a} &= \frac{w + b}{2w - b} \\ \Rightarrow w^2 + (b - 3a)w &= 0, \end{aligned}$$

and since $w \neq 0$ we find the width of the river to be $w = 3a - b$.

Applying this analysis to Loyd's original scenario we find that upon substituting $a = 720$ and $b = 400$, we again arrive at the conclusion that $w = 3 \times 720 - 400 = 1760$. Finally, the ratio $\frac{u}{v}$ is in this case:

$$\frac{u}{v} = \frac{a}{w - a} = \frac{720}{1760 - 720} = \frac{720}{1040} = \frac{9}{13}.$$

In words, the ratio of the speed of the slower to the faster ferry is 9 : 13.

The ferry boat problem attracted a number of responses from our readers. (Thanks to Elizabeth Bradford and Alex Bishop for their reading and collation work.) Dr Graham Baird gave a speed and distance analysis of the two ferries, leading to a river width of 1 mile, and a speed ratio of the 9 : 13. Professor Neville de Mestre showed that if the given distances were both measured from the same shore, then the width of the river would be 1280 yards and the speed ratio will turn out to be 7 : 9. We include de Mestre's answer as follows. Denote the river width in yards by W , and the speeds of the two ferries by s_1 and s_2 . Using time = distance/speed, we have the following equations for the first and second meetings respectively:

$$\frac{W - 720}{s_1} = \frac{720}{s_2}, \quad \frac{W}{s_1} + 10 + \frac{400}{s_1} = \frac{W}{s_2} + 10 + \frac{W - 400}{s_2}.$$

Equating $\frac{s_1}{s_2}$ from these equations then yields:

$$\frac{W - 720}{720} = \frac{W + 400}{2W - 400}$$

with solution $W = 1280$. The ratio of their speeds is then $s_1 : s_2 = 7 : 9$.



Peter Higgins is a Professor of Mathematics at the University of Essex. He is the inventor of Circular Sudoku, a puzzle type that has featured in many newspapers, magazines, books, and computer games all over the world. He has written extensively on the subject of mathematics and won the 2013 Premio Peano Prize in Turin for the best book published about mathematics in Italian in 2012. Originally from Australia, Peter has lived in Colchester, England with his wife and four children since 1990.



Talking Teaching

Edited by Diane Donovan*, Birgit Loch and Sid Morris*****

The opinions expressed here are those of the author and not necessarily of the Editors of this column or the Editors of the Gazette or the Australian Mathematical Society.

There has been much talk, as there often is at this time of the year, about the suitability of using ATAR alone as entry to university courses. I am not qualified to speak authoritatively on the most appropriate way to select students to enter medicine or dentistry or nursing courses.

I want, however, to discuss the selection of future mathematics high school teachers.

Let me be upfront about my credentials to talk on this. I have never taught mathematics at high school! However, I have marked thousands of HSC mathematics papers, set HSC mathematics exam papers, served as chair of university entrance committees, and been a member of the board which approved the senior high school syllabi across one Australian state. As well as the above experience in NSW, Victoria and South Australia, I have chaired university learning and teaching committees and have much experience teaching mathematics to university students including those who intend to be high school teachers.

I suggest that to be an excellent high school mathematics teacher one should be passionate about mathematics, passionate about teaching, and be able to teach well.

These do not require a very high ATAR. But they do require good mathematical ability, and the ability to teach is usually enhanced by good teacher training.

Of course temperament is relevant to whether someone will be a successful teacher. A high ATAR does not indicate that a student has an appropriate temperament to be a good teacher.

A good teacher requires good communication skills, as having the knowledge is not the same as communicating it well. To be convinced of this just look at the YouTube videos of some of the best mathematicians in the world.

However, to be a good teacher one should have a reasonable level of intelligence and this is not completely unrelated to ATAR. Also being good at mathematics and having good communication skills are not completely unrelated to ATAR.

*Email: dmd@maths.uq.edu.au

**Email: B.Loch@latrobe.edu.au

***Email: morris.sidney@gmail.com

So I am certainly not arguing that we should ignore ATAR entirely in selecting future high school mathematics teachers. However, a student with an ATAR score of say 75 may or may not have good mathematics results — so ATAR alone conceals information that could and should be used in selecting future high school mathematics teachers. We should argue that universities adopt an approach which does not rely on ATAR alone.

I am aware that many universities do accept students on the basis of recommendations from schools. While this is sometimes done so that the ATAR of students accepted does not (seem to) drop too low, on balance I strongly support this as an extra mechanism to be accepted into university

We should also promote the notion that high school teachers who do not have a major in mathematics at university should not teach high school mathematics.

Finally, I suggest that we should not join the chorus of tabloid writers who criticise universities that accept students with what they regard as low ATAR scores into teacher training courses. We should argue publicly that to attract students into the teaching profession we need to do all we can to improve the prestige of that profession. High school teachers should be paid a good salary. And we should loudly criticise those who suggest teachers have it easy because they have a short working day or lots of holidays — both are false.



Sid Morris has taught mainstream and service mathematics and computing courses to classes of up to 500 students at 12 universities on 4 continents at all undergraduate levels. His online text, accompanied by videos, is used in over 100 countries, and is translated into 8 languages. The facebook group of readers of his book has 8,000 members. He has published internationally 5 other undergraduate and advanced books and served as chair and member of university-wide teaching and learning committees.



Communications

Prime Minister's Prize for Science

Renowned mathematician Emeritus Professor Cheryl Praeger is the 2019 recipient of the prestigious Prime Minister's Prize for Science. She received the \$250,000 prize for her fundamental contributions to group theory and combinatorics, at a ceremony in Canberra in October.

Cheryl has had outstanding influence, publishing over 400 papers, supervising 30 PhD students, building a notable research group at The University of Western Australia and mentoring future Fields Medalist, Akshay Venkatesh, as a teenage undergraduate. She was also President of the AustMS from 1992 to 1994.

Speaking on ABC Radio https://abcmedia.akamaized.net/rn/podcast/2019/10/bst_20191017_0650.mp3 she said

To receive the award is a wonderful statement about the importance of mathematics, and such a recognition of the achievements of myself and my colleagues and students in our research in the mathematics of symmetry.

I believe that we need many more young people in maths and the STEM disciplines to solve and face the new challenges that will be facing us. We need creative thinkers and critical and logical thinkers to be able to distinguish and make progress.

In a long career, Cheryl has received many other honours, including being elected a fellow of the Australian Academy of Science in 1996, and becoming a Member of the Order of Australia in 1999. She has a long record of international outreach, with co-authors in many other countries including Korea, the Philippines, Thailand, China and Iran. She served as Foreign Secretary of the Australian Academy of Science between 2014 and 2018. She is a board member of the Association of Academies and Societies of Sciences in Asia (AASSA) and since 2017 has chaired its Women in Science and Engineering Special Committee. Most recently, as reported in the last issue, she is now a member of the International Science Council Standing Committee for Freedom and Responsibility in Science.

Inaugural Riemann Prize

The Riemann International School of Mathematics was founded in 2009 and was established in 2014 as a non-profit association. Its goal is to promote fundamental mathematical research and education, through international congresses, workshops, PhD courses and school activities. RISM has a stunning location within the prestigious premises of the Università degli Studi dell'Insubria at Villa Toeplitz in Varese, in Northern Italy. The **Riemann Prize** was established in 2019, on the occasion of the tenth anniversary of RISM. Along with RISM, its co-sponsors include all public and private universities of Lombardia, the government of Regione Lombardia, and the municipality of Varese. It is to be awarded every three years by an international committee (the first one composed by Enrico Bombieri, Institute for Advanced Studies; Alice Chang, Princeton University; Ron Donagi, University of Pennsylvania, Louis Nirenberg, Courant Institute of Mathematical Sciences and the President of RISM, University of Insubria) to outstanding mathematicians aged 40–65 who have reached breakthrough achievements, as a tribute to the prominent figure of Bernhard Riemann. Bernhard Riemann (1826–1866) was among the greatest mathematicians of all times. His name is all over modern mathematics: Riemann sums and integrals, the Riemann zeta function and the Riemann Hypothesis, Riemannian geometry, Riemann surfaces and the Riemann sphere. Two generations later, his work served as a crucial tool in Einstein's development of general relativity.

The inaugural prize will be awarded to Terence Tao in 2020 at the Università degli Studi dell'Insubria in Varese. The ceremony will be the culmination of week-long activities in honour of the awardee, a research conference and a mathematical festival. The prize will include a piece of art made by Master Marcello Morandini. For more information www.rism.it.

Terence Chi-Shen Tao, a graduate of Flinders University and Princeton University, now based at the University of California in Los Angeles, USA, has worked in various areas of mathematics. He currently focuses on harmonic analysis, partial differential equations, geometric combinatorics, arithmetic combinatorics, analytic number theory, compressed sensing, and algebraic combinatorics. Tao was a recipient of the **2006 Fields Medal** and the **2014 Breakthrough Prize in Mathematics**. He is also a 2006 MacArthur Fellow. He is the author or co-author of 275 research papers, his most impressive results being those on three-dimensional Navier-Stokes existence and smoothness.

2019 ANZIAM Awards

The 2019 ANZIAM Medal

The presentation of these awards was made at ANZIAM 2019 in Nelson, New Zealand, on 6 February 2019.

Citation for Peter Taylor

Professor Peter Taylor is an outstanding applied mathematician internationally known for his contributions to the theory and applications of mathematics, particularly in the area of applied probability. He has developed modelling, analytical and computational techniques for mathematical structures that are commonly used in the analysis of real-world stochastic systems. Peter Taylor has provided valuable leadership to the mathematics community both nationally as President of the Australian Mathematical Society and internationally through his active roles as editor and reviewer for several respected international journals. Peter Taylor was Chair of ANZIAM and he played a key part in the design and implementation of the ANZIAM/CSIRO Student Support Scheme that has become an exemplar for other similar schemes elsewhere.

The ANZIAM medal is ANZIAM's most prestigious award and recognises research achievement, wide-ranging activities enhancing the discipline of applied and industrial mathematics and contributions to ANZIAM. Peter Taylor has made an outstanding contribution in these three areas and is a most worthy recipient of the ANZIAM medal.



Peter Taylor (left) and Phil Howlett (right). Photo credit: Mark McGuinness

Research Achievements

Peter Taylor was awarded a PhD in 1987 from the University of Adelaide for his work on applied probability under the supervision of Bill Henderson and Charles Pearce. This early work demonstrated both mathematical intuition and rigour. His

understanding of the ubiquitous nature of stochastic behaviour in applications was enhanced greatly through his affiliation with the University of Adelaide's statistical consulting group and the Teletraffic Research Centre (of which Peter was Director for four years), as well as his own consulting work. As a result, Peter's research interests are extremely broad as is reflected in his current projects which include mechanism design in economic systems, modelling extreme rainfall events, bushfire re-ignition probabilities, the spread of epidemics, nonparametric deconvolution, customer credit card behaviour, biosensor experiments and Bitcoin.

Peter has also made important advances in the study of queueing networks with batch arrivals where his early work with colleagues Bill Henderson and Charles Pearce has been cited by numerous authors. His early work dealt with the related concepts of insensitivity and product-form queueing networks and, with various co-authors, he proved the existence of product-form invariant measures in a number of different multidimensional stochastic models. Two recent highlights are his work with Robert Maillardet on queues with advanced reservations and his work with David Stanford and Ilze Ziedins on accumulating priority queues, which promises to have significant application in healthcare systems.

In 1992, Peter started working with V. Ramaswami on quasi-birth-and-death processes. This collaboration also sparked an interest in matrix-analytic methods and Peter has worked in this area ever since. His 1996 paper with PhD student Les Bright was the first to show how to extend matrix-analytic methods to level-dependent quasi-birth-and-death processes (QBDs) and his 2004 paper with Dirk Kroese and Werner Scheinhardt observed that strange and counter-intuitive behaviour can occur in QBD models that have infinitely many phases. This paper triggered a number of papers from a variety of authors examining matrix-analytic models with infinite phase spaces, to the extent that their properties are now well-understood. As of 2018, Peter has written 30 research papers in the area of matrix-analytic methods, many with his long-term colleague Guy Latouche. Peter is an internationally recognised expert in this area, having three times been a Program Co-Chair of the International Workshop on Matrix-Analytic Methods, and having been invited to give extended tutorials on matrix-analytic methods in a number of forums.

With Nigel Bean and Frank Kelly, Peter studied Braess's paradox, in which addition of resources to a network can result in diminished service for all and, with Greg Harmer and Derek Abbott, he provided the first mathematical analysis of Parrondo's games, in which a certain type of mixture of two losing games can be shown to be winning.

Activities Enhancing Applied or Industrial Mathematics

In addition to his formal positions in ANZIAM and AustMS, Peter Taylor has shown exemplary leadership in the wider applied and industrial mathematics community. He is currently Director of the ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS) and an Australian Research Council Laureate Fellow. He has been the Editor-in-Chief of one international journal and is on the Editorial Board of three others. From the beginning of 2019 he will become

Editor-in-Chief of *Advances in Applied Probability* and the *Journal of Applied Probability*, two of the most prestigious applied probability journals in the world. He has been on awards committees for INFORMS, including chairing the Nicholson Prize Committee, which awards the prize for the best student paper in operations research and management science worldwide and the Applied Probability Section Awards Committee, which awards the Erlang Prize as well as the best paper award in applied probability, again worldwide.

Peter has supervised 26 PhD students, one research masters and 44 honours/coursework masters students to completion, with a number of others in the pipeline. Many of these students have gone on to excellent careers in government, industry or academia.

As Director of the University of Adelaide's Teletraffic Research Centre (TRC) in the late 1990s, Peter was responsible for performance models used by the TRC's major client, Telstra. The mathematical models behind this work spilled over into Peter's research, resulting in papers on many types of telecommunications modelling.

Contributions to ANZIAM

Peter Taylor has been an active member of the ANZIAM community since he first attended the Applied Maths Conference at Merimbula in 1984. He has held the positions of Chair of ANZIAM, President of the Australian Mathematical Society, Secretary of the Applied Maths Conference, Deputy Convenor of the Engineering Mathematics Conference, Chair of the ANZIAM Invited Speakers Committee (twice), Chair of the EO Tuck Medal Committee and many other ANZIAM committee roles.

One of Peter's key achievements as Chair of ANZIAM was to help establish the ANZIAM/CSIRO Student Support Scheme (SSS), which is used to support student attendance at the annual ANZIAM meeting and the meetings of the ANZIAM special interest groups. Peter was responsible for drawing up the principles of the SSS and was the first Chair of the panel that makes the funding awards.

The ANZIAM Medal selection panel unanimously recommends that Professor Peter Taylor be awarded the ANZIAM Medal for 2019.

On behalf of ANZIAM:

Frank de Hoog (CSIRO)
Phil Howlett (University of South Australia)
Kerry Landman (University of Melbourne)

The 2019 EO Tuck Medal

In honour of the late Ernest Oliver Tuck, FAustMS, FTSE and FAA, ANZIAM has instituted a mid-career award for outstanding research and distinguished service to the field of Applied Mathematics.

Citation for Scott W McCue

Professor Scott McCue, from Queensland University of Technology, is an outstanding applied mathematician with expertise across a broad range of research areas, and is an inspirational and committed leader in the ANZIAM community.



Scott McCue (left) and Shaun Hendy (right). Photo credit: Mark McGuinness

In particular, Scott's research has a focus on developing and applying theoretical and computational techniques to problems in interfacial dynamics and mathematical biology, but he has also made broader contributions to industrial mathematics. Scott has led numerous funded research projects, and has received over \$2.8 million funding for ARC Discovery and Linkage Projects, including \$740K from his industry partners.

Scott's primary expertise is in the area of interfacial dynamics, which concerns developing and analysing mathematical models for complex processes that involve moving interfaces. Scott has applied conformal mapping, integral transforms and boundary integral methods to study surface gravity wave problems, specialising in both linear and nonlinear settings. He has published numerous papers in this area, including five in the prestigious *Journal of Fluid Mechanics*. In recent years, Scott's research group at QUT has also developed new extremely efficient computational methods and applied these techniques to study unusual features of highly nonlinear ship wave patterns.

Scott's research in interfacial dynamics also covers nonlinear moving boundary problems in Hele-Shaw and Darcy flow, focussing on selection problems, viscous fingering, pattern formation, self-similarity and singularity structure. A closely

related subject of Scott's research is in the area of Stefan problems, for which Scott is well known for his asymptotic analysis of 'hole-closing' problems.

Scott's second research area is mathematical biology, in particular developing and analysing reaction diffusion models and random walk processes for collective cell motion, with applications to wound healing and cancer biology. The impact of this work is both in applied mathematics itself and for end users in biology. The highlights of Scott's work in this area include new insights into nonlinear degenerate diffusion for cell migration and mechanochemical models for tissue growth.

The third area of Scott's research is industrial mathematics, which involves applying a suite of mathematical modelling techniques to solve practical problems of direct relevance to industry partners. Scott leads a large project, funded by two ARC Linkage grants, which is constructing a suite of mathematical models to investigate spray droplet interactions at the single leaf, whole plant and crop level. The mathematical components of this project have led Scott and his group to new discoveries in the fields of thin film flows over curved surfaces and droplet impaction on hydrophobic surfaces.

Scott has made an exceptional contribution to the teaching and supervision of students and emerging researchers. He has supervised 7 post-doctoral fellows and 14 PhD students to completion, as well as supervising an additional 46 undergraduate, summer, Honours or Masters projects. In terms of opportunity, Scott has held a traditional academic position since 2005 with a full teaching load. In recent years, he has taken on significant leadership roles at QUT including being the Discipline Leader for Applied and Computational Mathematics, ERA Director for the Science and Engineering Faculty and HDR Director for the School of Mathematical Sciences.

Scott has been an important leader in the ANZIAM community. He served two 2-year terms (2006–2007 and 2010–2011) on the ANZIAM Executive. He has attended 20 ANZIAM conferences and has served as a member of the TM Cherry Prize Committee on four occasions. He was Secretary of the ANZIAM Conference in Caloundra in 2009, and in 2015 was co-Director for the annual ANZIAM Conference in Surface Paradise. As a Director, Scott led the organisation of this successful conference and developed the well-received scientific program. Scott demonstrated leadership in the ANZIAM community by playing a major role in the invited speakers committee, acting as MC for the conference dinner and awards ceremony, and facilitating the Women in Mathematics Lunch.

Scott is the Chair of the Michell Medal Committee in 2018, after serving as Incoming Chair in 2017. Scott is an ongoing Trustee in the AF Pillow Applied Mathematics Trust, a role that involves reviewing Trust activities and ranking the applications for the AF Pillow Applied Mathematics PhD top-up Scholarship. Since February 2008 Scott has been on the Editorial Board of the ANZIAM Journal, handling 85 articles in both the printed journal and the electronic supplement.

Scott was Chair of QANZIAM for the four years 2006–09. In this role, Scott represented QANZIAM in the ANZIAM community, formulating and reporting on

QANZIAM activities, and successfully advocating for a significant increase in annual funding. Scott has organised four annual QANZIAM conferences. Under Scott's leadership, the QANZIAM Executive put in place strategies to further engage with students, for example by waiving student registration fees and by funding a student prize for the most outstanding student presentation.

The selection panel unanimously recommends that Professor Scott McCue be awarded the ANZIAM EO Tuck Medal for 2019.

On behalf of ANZIAM:

Troy Farrell (QUT)
Shaun Hendy (University of Auckland)
Yvonne Stokes (University of Adelaide)
Peter Taylor (University of Melbourne)

The 2019 JH Michell Medal

The JH Michell Medal, named in honour of John Henry Michell, is awarded annually by ANZIAM to an outstanding new researcher who has undertaken distinguished research in applied and/or industrial mathematics, where a significant proportion of the research has been carried out in Australia and/or New Zealand.

The JH Michell Medal Committee for 2019 was highly impressed with all of the nominations; however, there was one nominee who stood out as the most outstanding. The 2019 JH Michell Medal is awarded to Professor Ryan Loxton from Curtin University.



Photo credit: Curtin University

Citation for Ryan Loxton

Ryan Loxton is a Research Professor and ARC Future Fellow. After completing his PhD on optimal control in 2010, Ryan progressed rapidly through the academic ranks, reaching full professor at the age of 34 to become one of the youngest ever professors at Curtin University. Since his PhD, his research has moved into areas

such as nonlinear optimisation, operations research, and system identification. He has co-authored over 50 papers across a broad range of international journals in applied and computational mathematics, attracting over 1400 citations on Google Scholar.

Ryan's research has applications across a wide range of industries such as mining, oil and gas, agriculture, and industrial process control. Indeed, Ryan is a passionate advocate for industry engagement and has worked with many companies including Woodside Energy, Linkforce, and Vekta Automation. He currently leads the optimisation theme in the new *ARC Industrial Training Centre on Transforming Maintenance through Data Science*, which is funded by a \$3.9 million grant from the ARC plus matched funding from industry partners Alcoa, BHP Billiton, and Roy Hill.

Apart from this ARC Industrial Training Centre grant, Ryan has attracted substantial research funding from both industry and the ARC, including two ARC fellowships, three ARC Discovery grants and one ARC Linkage grant. Ryan has worked with the company Linkforce since 2014 on optimising shutdown maintenance operations in the resources sector, which has led to award-winning software technology. Ryan's research with other companies such as Woodside Energy and Global Grain Handling Solutions has also led to real impact through new decision support tools based on rigorous optimisation algorithms.

Ryan has been recognised for his research by being awarded the 2014 West Australian Young Scientist of the Year – he was the first mathematician to win this award.

The Committee regards Professor Ryan Loxton as an outstanding early career researcher and as a worthy recipient of the 2019 JH Michell Medal. Well done Ryan!

On behalf of ANZIAM:

Scott McCue (Chair, Queensland University of Technology)

Mark Nelson (University of Wollongong)

Nigel Bean (University of Adelaide)

Higher Degrees and Honours Bachelor Degrees in Mathematics and Statistics Completed in Australia in 2018

Peter Johnston*

This report presents data relating to students who completed Honours or Higher Degrees in Mathematics during 2018. The data are part of an on-going project for the Australian Mathematical Society and should be read in conjunction with previous reports [1]–[19] covering the period 1993–2017.

Appendix 1 presents data for students completing Honours degrees in 2018, at all Universities in Australia. Within each institution, the data are broken down into male and female students and into the three traditional areas of Mathematics: Pure; Applied, and Statistics. There is also the general category “Mathematics” for institutions that do not differentiate between the conventional areas. Finally, there is an “Other” category for newer areas of mathematics such as Financial Mathematics. Each category is further broken down into grades of Honours awarded. Appendix 2 presents the coursework masters degrees (with classifications) awarded by the University of Melbourne in 2018. In the discussions that follow, these data have been merged together and will be referred to simply as “Honours”. Appendixes 1 and 2 combined show that in 2018 there were 184 Honours completions in Australia, with 128 (70%) receiving First Class Honours (compared with 113 out of 171 (66%) in 2017 and 96 out of 160 (60%) in 2016). Over recent years the average fraction of First Class degrees awarded has been about 65%.

Figure 1 presents the total number of students completing Honours degrees in Mathematics, including two year Coursework Masters degrees (with classifications) over the period 1959–2018. It shows that in 2018 the number of Honours completions has again increased slightly over the previous two years and is slowly approaching the high numbers of completions in the years prior to that. The figure also shows the numbers of male and female students who completed Honours over the same time period. Last year, there was again a small increase in the number of male students with 136 completions (compared to 127 in 2017 and 124 in 2016), with the number of female students also increasing, up to 48 (compared to 44 in 2017 and 36 in 2016).

Appendix 3 presents the data for Higher Degree completions in 2018. The data are broken down into traditional Coursework Masters, Research Masters and PhD degrees, with the latter two divided into the three typical areas of Mathematics.

*School of Environment and Science, Griffith University, Nathan, QLD, 4111.
Email: P.Johnston@griffith.edu.au

These data are also represented in Figure 2, as part of the overall Higher Degree data for the period 1959–2018. The figure shows that:

1. There was a significant increase in the number of PhD completions compared with 2017, which continues the overall increasing trend over the past 20 years.

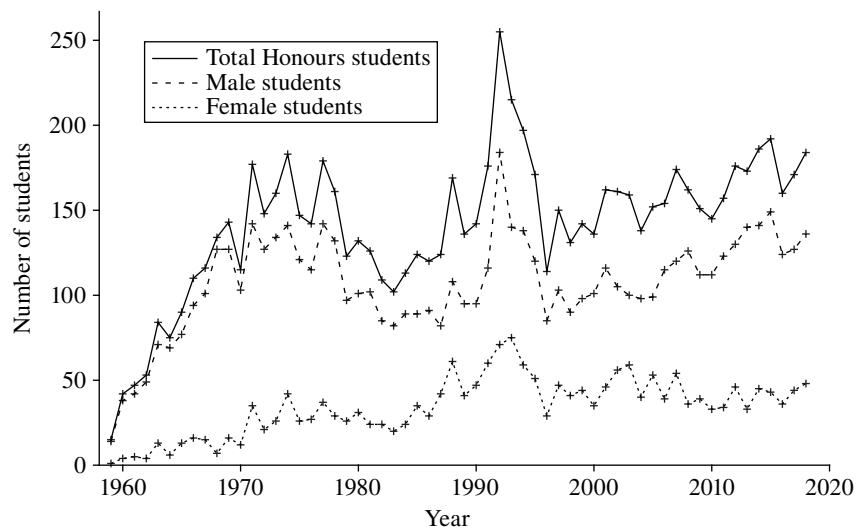


Figure 1. Number of Honours degrees, including two year Coursework Masters degrees (with classifications), completed in Mathematics and Statistics, 1959–2018.

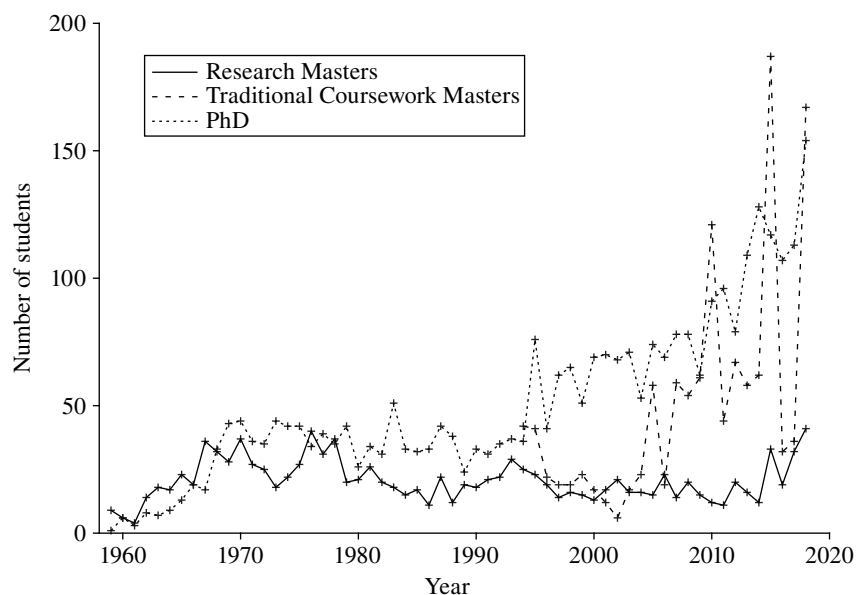


Figure 2. Number of research higher degrees completed in Mathematics and Statistics, 1959–2018.

In 2018, there were 153 PhD completions (compared with 113 in 2017 and 107 in 2016), of which 108 were by male students and 45 by female students. This shows a large increase in the number of completions by male students (77 in 2017), and a smaller increase in the number of completions by female students (36 in 2017).

2. The number of Research Masters completions (41) increased slightly, up from 32 in 2017 and is the largest number of completions in recent years. This is partly due to the inclusion of Macquarie University's new Research Masters program.
3. The number of traditional coursework masters completions increased massively with 167 completions in 2018, compared to 36 in 2017 and 32 in 2016, similar to the 187 completions recorded in 2015.

This year represents the eighth occasion that data have been reported for two year coursework masters degrees with classifications (similar to existing Honours degrees). The University of Melbourne is the only university to offer such degrees in place of the traditional Honours degree, although some other universities are expected to follow this model. As time goes on, and more universities offer coursework masters degrees of this type, the two data sets will be differentiated and displayed as separated entities (backdated to 2011).

For those who are interested in the finer details, the raw data are available directly from me. Simply send me an e-mail. I have an Excel spreadsheet containing the complete data for 2018 as well as spreadsheets containing cumulative data from 1959 for Honours, Research Masters and PhD degrees.

I would like to thank the many people who took the time and effort to collect this data and forward it to me. This year I received 29 out of a possible 38 responses to requests for data, which is similar to last year's response rate, but down from the number of responses received in recent years. Finally, if having read this report, you would like to contribute missing data for 2018, I would be happy to add it to the spreadsheet.

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Appendix 1. (Continued.)

Uni.	Sex	Maths				Pure				Applied				Statistics				Other				Honours Total
		I	IIA	IIB	III	I	IIA	IIB	III	I	IIA	IIB	III	I	IIA	IIB	III	I	IIA	IIB	III	
GFU	M									2												2
	F																					0
JCU	M																					0
	F									1												1
LTU	M					1	1			1				1								4
	F																					0
MDU	M																					0
	F																					0
MNU	M					3	1			5				3								12
	F					4																4
MQU	M																					0
	F																					0
QUT	M	3	2																			5
	F		1																			1
RMT	M									1												1
	F										1											1
SCU	M																					0
	F																					0
SUT	M																					0
	F																					0
UAD	M									1	2	1	1	2								7
	F									2	2											4
UCB																						0
																						0
UNC	M	3	1																			4
	F																					0
UNE	M					2																2
	F																					0
UNS	M					5	1			2	1			6	2							17
	F					1				1				2								4
UQL	M					3	1	1		2				1			2	1				11
	F									1												1
USA																						0
																						0
USN	M					4				2				1								7
	F									2	1			1								4
USQ	M																					0
	F																					0
UTM																						0
																						0
UTS	M												1									1
	F					1				1	1											3
UWA	M					2								4	1							7
	F						1								2							3
UWG	M					4				3				1			4	1	1			14
	F					1								1			3					5
UWS	M																					0
	F																					0
VUT																						0
																						0
Totals		6	5	0	0	38	7	1	0	28	9	2	1	23	5	0	0	9	1	2	0	137

Appendix 2. Number of two year coursework masters degrees (with classifications) completed in Mathematics and Statistics, 2018

Uni.	Sex	Pure			Applied			Statistics			Other			Total
		I	IIA	IIB	III	I	IIA	IIB	III	I	IIA	IIB	III	
UMB	M	6	1	1		7	1	2	1	6	3	4	1	33
	F				1	4		1		1	2	3	2	14
Totals		6	1	1	1	11	1	3	1	7	5	7	3	47

Appendix 3. Number of research higher degrees completed in Mathematics and Statistics, 2018

Uni.	Sex	Coursework Masters	Research Masters			Research Masters Total	PhD			PhD Total
			Pure	Applied	Statistics		Pure	Applied	Statistics	
ACU	M					0				0
	F					0				0
ADF	M					0			1	1
	F					0		1		1
ANU	M			4	1	5		2		3
	F			1		1			1	0
BOU	M					0				0
	F					0				0
CDU	M					0				0
	F					0				0
CQU	M					0				0
	F					0				0
CSU	M					0				0
	F					0				0
CUT	M					0				0
	F					0				0
DKU	M					0				0
	F					0				0
ECU	M					0		1	1	2
	F					0				0
FDU	M				1	1		1		1
	F	3				0		1	1	2
FED	M					0		1		1
	F					0		1		1
GFU	M					0		1		1
	F					0				0
JCU	M					0				0
	F					0				0
LTU	M				3	3		1		1
	F				3	3		1	2	3
MDU	M					0				0
	F					0				0
MNU	M	10				0	6	5	2	13
	F	5				0		1	1	2
MQU	M			3	1	2	6	2	1	4
	F					1	1		1	1
QUT	M				2	2		3	1	4
	F			1		1	2	1	2	3

Appendix 3. (Continued)

Uni.	Sex	Coursework Masters	Research Masters			Research Masters Total	PhD			PhD Total	
			Pure	Applied	Statistics		Pure	Applied	Statistics Other		
RMT	M	54				0	3	5		8	
	F	27				0	1			1	
SCU	M					0				0	
	F					0				0	
SUT	M					0	1			1	
	F					0	1			1	
UAD	M		3	2		5	1	4	1	6	
	F					0				0	
UCB	M					0				0	
	F					0				0	
UMB	M					0	5	4	6	6	
	F					0	1	3	1	3	
UNC	M					0	2	1		3	
	F					0				0	
UNE	M	1				0	1			1	
	F					0				0	
UNS	M	28	1			1	1	3		4	
	F	18				0			2	2	
UQL	M		1			1	2	2	1	5	
	F					0	2	2	2	4	
USA	M					0				0	
	F					0				0	
USN	M					0	3	6	3	12	
	F					0		3		3	
USQ	M	2		1		1	1	2		3	
	F	2				0	1	1		2	
UTM	M					0				0	
	F					0				0	
UTS	M	4				0	3			3	
	F	5				0				0	
UWA	M		2	3	3	8	2	2	1	3	
	F					0	2	1	1	3	
UWG	M	4				0	1	5	1	7	
	F	4				0		3	1	4	
UWS	M			1		1				0	
	F					0	1			1	
VUT	M					0				0	
	F					0				0	
Totals		167	16	11	14	41	34	68	43	9	153

Equity, Diversity and Inclusion Committee

2019 Report

Nalini Joshi*

The EDI Committee was established a year ago as a committee of the Australian Mathematical Society. Our aims are to

- (1) promote the objectives of the Society in so far as this concerns equity, diversity and inclusion practices. Both gender diversity and inclusivity of Indigenous peoples and knowledges are major focii of the committee, but they are not its only focii.
- (2) promote awareness of equal opportunity for Society members.
- (3) provide strategic advice to Council on matters relevant to diversity practices.

Below, we report on actions we have recommended to the Council of the AustMS and some that are currently in discussion.

1. Major actions

The EDI committee's terms of reference (ToR) were approved by Council of the AustMS. These include two new activities to be delivered at each annual conference:

- (i) the Dr Mandawuy Yunupingu lecture, and,
- (ii) an Equity Diversity and Inclusion special session.

These are to begin officially at the 2020 AustMS conference. We note that the Director of the 2019 AustMS conference is already following the spirit of these recommendations.

The Dr Yunupingu lecture is designed to increase the visible representation of under-represented groups in mathematics, such as mathematicians who are women, Indigenous, LGBTIQ, gender-diverse, of non-European ethnicity or are disabled. The speaker should be a representative of such an under-represented group.

The topic of the lecture may be on mathematical research, or on issues surrounding equity and diversity in mathematics, or both. Examples beyond traditional mathematical research might include research into the statistical distribution, history or sociological/anthropological factors affecting the population of mathematicians from under-represented backgrounds, or research into mathematics education in societies or groups from such under-represented backgrounds. Such topics should also be the subject of talks in the EDI special session.

*The University of Sydney. Email: nalini.joshi@sydney.edu.au

The EDI committee also recommended a Code of Conduct for the society, which was approved by Council and may be found on the AustMS website at <https://www.austms.org.au/Code+Of+Conduct>. All members of AustMS and participants in AustMS-sponsored events should be made aware that adherence to this code is a mandatory requirement of AustMS membership and of participation in an AustMS event.

The code outlines examples of unacceptable behaviour and mentions consequences for those who are found to be in contravention of the code. But the detailed procedures to be followed in such cases are currently in discussion.

2. Actions being considered

Several additional actions are currently being discussed and formulated.

2.1. Code of conduct and associated procedures. The appropriate process to be followed when AustMS is notified of cases that contravene the code of conduct is currently being formulated. We have suggested a model that is based on the procedures that were established by the International Society for Bayesian Analysis. (See <https://bayesian.org/governance/code-of-conduct/>.)

Related topics of discussion include

- (i) How to unify various Codes of Conduct that have been (or are currently being) established for the Divisions of AustMS?
- (ii) How to coordinate the associated processes between the Divisions?
- (iii) What disciplinary actions are appropriate and how should they be implemented?

We note that as of 01 July 2019, new rules for Incorporated Associations were introduced in the ACT and that these have impact on the proposed procedures to be followed when the code of conduct may be violated by a member of the AustMS. In particular, Section 65C of the rules describes the framework that must be followed by the AustMS for any disciplinary action against a member. This requires that the rules of the AustMS must state

- (a) the procedure (if any) for disciplining members; and
- (b) the way (if any) in which a member may appeal in respect of any disciplinary action taken against the member; and
- (c) the way (if any) in which a member may make representations to, or appear before, the association or its delegate, in relation to any charge made against the member.

We suggest that Council should consult with the AustMS public officer, Dr John Cossey, to determine the interpretation of what constitutes rules for the society.

2.2. Communication. The establishment of the Dr Mandawuy Yunupingu lecture and EDI special session have revealed issues of communication between the EDI committee and committees that have responsibility for organizing the annual meetings. We suggest that all future Directors for AustMS meetings include a

liaison role with the EDI committee on their Program Advisory Boards and that consultation with the EDI committee commence at the same time or earlier than that with the Invited Speakers committee.

2.3. Prizes and awards. The EDI committee is in the process of formulating new rules for the AustMS Medal. The primary change being considered is to replace the current eligibility criterion based on age, by one that reflects time elapsed since the award of a PhD, taking into account career interruptions.

2.4. Visibility of EDI issues. Issues related to Equity Diversity and Inclusion tend to be invisible to many in the mathematical community in Australia. With this in mind, we are currently gathering ideas to increase visibility, such as the following:

- (a) Posting interviews and/or short videos with AustMS members from under-represented groups on the AustMS website;
- (b) Regular LGBT + Allies Morning Tea at all AustMS sponsored meetings;
- (c) Acknowledgement of or Welcome to Country at the beginning of all AustMS sponsored events;
- (d) Publishing a calendar of diversity events throughout the year.

2.5. Statistics. The remit of the EDI committee includes the gathering of data on under-represented groups. This is difficult to initiate at present, as the AustMS does not gather any such data. We suggest this as an action for the President.

AMSI-AustMS Workshop Subfactors in Sydney

UNSW Sydney
4–8 February 2019

Arnaud Brothier,* Pinhas Grossman and Susannah Waters*****

This conference was hosted by the School of Mathematics and Statistics at UNSW (University of New South Wales).

Invited presentations spanned a variety of topics in operator algebras, representation theory, conformal field theory, quantum computing, and group theory. In addition to the subfactor groups at UNSW and the Australian National University, there was also participation from the algebra and representation theory groups at University of Sydney and University of Melbourne.

Talks were lively with most attracting multiple questions and comments from the audience. The workshop featured 20 speakers representing nine different countries. Nine speakers were Australia-based, and six speakers were Early Career Researchers.

Speakers included two US-based Fields Medallists, Professor Sir Vaughan Jones (Vanderbilt University) and Professor Michael Freedman (Microsoft Quantum – Santa Barbara).



Professor Sir Vaughan Jones (photo: Andrew Schopieray, UNSW Sydney)

Subfactor theory was initiated in the 1980s by Professor Vaughan Jones as part of the theory of operator algebras. Operator algebras have been closely linked to mathematical physics since their introduction by Murray and von Neumann in the early twentieth century. Jones discovered a surprising link between subfactors and knots, which led to the formation of the new field of quantum topology.

*Email: a.brothier@unsw.edu.au

**Email: p.grossman@unsw.edu.au

***Email: s.waters@unsw.edu.au



Professor Michael Freedman (photo: Andrew Schopieray, UNSW Sydney)

In recent years, subfactor theory has developed connections to the theory of modular tensor categories. Modular tensor categories are used in mathematical models for topological quantum computing, an approach to quantum computation pioneered by Kitaev in the 1990s. One of the leaders in topological quantum computing is topologist Professor Michael Freedman, who heads a group working to build a quantum computer at Microsoft's Station Q in Santa Barabara. One of the themes of the workshop was the growing connection between subfactor theory and topological subfactor theory and topological quantum computing.

Thank you to the conference organisers: Arnaud Brothier, Pinhas Grossman, Scott Morrison, Julia Plavnik, Andrew Schopieray and James Tener.

Thank you to our sponsors: AMSI; AustMS; UNSW School of Mathematics and Statistics.



Conference participants (photo: Andrew Schopieray, UNSW Sydney)

Workshop on Applications of Nonlinear Diffusion Equations

La Trobe University, City Campus
19–21 June 2019

Bronwyn Hajek,* Dimetre Triadis and Rebecca Chisholm

This three-day workshop was timed to coincide with the retirement of Professor Phil Broadbridge and a celebratory dinner was held on the Thursday evening.

The meeting attracted delegates from all over Australia and the world. There were attendees from Canada, Italy, New Zealand, South Africa, the UK and the Ukraine, plus a significant delegation from Japan. Five Australian states were represented.



Workshop participants (photo: Mark McGuinness)

There were 48 registered attendees in total, with 26 contributed talks and plenty of time in the program for discussion. There were seven invited speakers:

- Clara Nucci (University of Perugia, Italy), A 25-year review of the role of heir-equations

*School of Information Technology and Mathematical Sciences, University of South Australia.
Email: Bronwyn.Hajek@unisa.edu.au

- Kenji Kajiwara (Kyushu University, Japan), The Burgers-type equations in the deformation theory of curves
- Roman Cherniha (Institute of Mathematics of NASU, Ukraine), A hunter-gatherer-farmer population model: Lie symmetries, exact solutions and their interpretation
- Maureen Edwards (University of Wollongong, Australia), Lie symmetries and solutions of nonlinear differential equations: a talk in two parts
- Mary Pugh (University of Toronto, Canada), Smectic Electroconvection, Poisson-Nernst-Planck Equations, and oddities in time-stepping
- Masato Wakayama (Kyushu University), Heat kernel of the quantum Rabi model
- Philip Broadbridge (La Trobe University), Conditionally integrable nonlinear diffusion models

Kerry Landman gave a talk, co-written by Bob Anderssen, entitled ‘An ODE to the Broad-Bridge that is Phil’. This was a very entertaining tribute to Phil Broadbridge’s career and wide-ranging research interests and was a charming walk down memory lane for many. The talk began in a poetical style (it was an ode, after all), but did not continue that way for long, for fear of driving the audience batty. Phil had the right of reply during his talk which followed Kerry’s and he gave us a demonstration of his baritone voice, before speaking about more serious matters such as integrability.

The workshop was very friendly and collaborative, with a stimulating combination of theory and application.

The organisers gratefully acknowledge support from AMSI, AustMS, La Trobe University, and the Institute of Mathematics for Industry, Kyushu University.



Technical Papers

The n -matchstick challenge accepted

James East*

In the 2016 edition of this *Gazette*, Professor Neville de Mestre [2] described the n -matchstick challenge. Education researchers Pat Graham and Helen Chick [4] had previously considered a special case: Give school children 20 matchsticks (!) and ask how many triangles could be made. The n -matchstick challenge is equivalent to counting the triangles with integer sides and perimeter n , up to conjugacy. And this, in turn, is equivalent to calculating the size t_n of the set

$$T_n = \{(a, b, c) \in \mathbb{Z}^3 : 1 \leq a \leq b \leq c < \frac{n}{2}, a + b + c = n\}.$$

Mathematicians actually solved this problem a few decades ago. The first solution is apparently due to Jordan, Walch and Wisner in 1979 [6], who gave a case-by-case formula for t_n . But the neatest solution is Honsberger's [5], which states that (writing $[x]$ for the nearest integer to x):

$$t_n = \left\lfloor \frac{n^2}{48} \right\rfloor \text{ for even } n \quad \text{and} \quad t_n = \left\lceil \frac{(n+3)^2}{48} \right\rceil \text{ for odd } n. \quad (1)$$

See also [3], which solves the corresponding problem for arbitrary polygons, and which contains references to other formulae for t_n , and to many existing proofs of Honsberger's formula. The purpose of this note is to outline yet another proof, which the author believes is the most elementary in the literature, possibly suitable for a guided assignment in an undergraduate Discrete Mathematics class.

First, for each $n \geq 0$, one may check that there is a well-defined function

$$\phi_n : T_n \rightarrow T_{n+3} \quad \text{given by} \quad \phi_n(a, b, c) = (a + 1, b + 1, c + 1).$$

This function is clearly injective, which means that $\text{im}(\phi_n)$ has size t_n , and so

$$t_{n+3} = t_n + |T_{n+3} \setminus \text{im}(\phi_n)|. \quad (2)$$

The next step is to show that

$$\text{im}(\phi_n) = \{(d, e, f) \in T_{n+3} : f < \frac{n}{2} + 1\}. \quad (3)$$

The forward containment is clear, in light of the rule for ϕ_n , and the fact that any triple $(a, b, c) \in T_n$ satisfies $c < \frac{n}{2}$. For the reverse, the key point is that any $(d, e, f) \in T_{n+3}$ with $f < \frac{n}{2} + 1$ satisfies $d \neq 1$, which follows from $1 + e + f \leq 1 + 2f < 1 + 2(\frac{n}{2} + 1) = n + 3$.

Next we note that any triple $(d, e, f) \in T_{n+3}$ satisfies $f < \frac{n+3}{2}$. If n is odd, this implies $f \leq \frac{n+1}{2} < \frac{n}{2} + 1$. In light of (3), this means that ϕ_n is surjective for odd n .

For even $n = 2k$, it follows from (3) that $T_{n+3} \setminus \text{im}(\phi_n)$ contains precisely the triples of the form $(d, e, \frac{n}{2} + 1) = (d, e, k + 1)$. Such a triple satisfies $d + e = k + 2$

*Centre for Research in Mathematics and Data Science, Western Sydney University.
Email: J.East@WesternSydney.edu.au

and $1 \leq d \leq e$, and there are $\lfloor \frac{k+2}{2} \rfloor = \lfloor \frac{n}{4} \rfloor + 1$ solutions to this. (Here $\lfloor x \rfloor$ is the floor function.)

Combined with (2), the previous two paragraphs yield the recurrence:

$$t_0 = t_1 = t_2 = 0 \quad \text{and} \quad t_{n+3} = \begin{cases} t_n & \text{if } n \text{ is odd} \\ t_n + \lfloor \frac{n}{4} \rfloor + 1 & \text{if } n \text{ is even.} \end{cases} \quad (4)$$

The relationship $t_n = t_{n+3}$ for odd n suggests concentrating on the even terms, so we define $e_k = t_{2k}$ for $k \geq 0$, with the aim to show that $e_k = \lfloor \frac{(2k)^2}{48} \rfloor = \lfloor \frac{k^2}{12} \rfloor$. Two applications of (4) give

$$e_{k+3} = t_{2k+6} = t_{(2k+3)+3} = t_{2k+3} = t_{2k} + \lfloor \frac{2k}{4} \rfloor + 1 = e_k + \lfloor \frac{k}{2} \rfloor + 1 \quad \text{for } k \geq 0.$$

We have arrived at the recurrence

$$e_0 = e_1 = e_2 = 0 \quad \text{and} \quad e_{k+3} = e_k + \lfloor \frac{k}{2} \rfloor + 1 \quad \text{for } k \geq 0. \quad (5)$$

If one did not already know/suspect that $e_k = \lfloor \frac{k^2}{12} \rfloor$, then one could use the recurrence (5) to find and plot several points (k, e_k) .[†] See Figure 1, which does so for $k = 0, 1, \dots, 12$, and suggests an obvious relationship with the curve $y = \frac{x^2}{12}$.

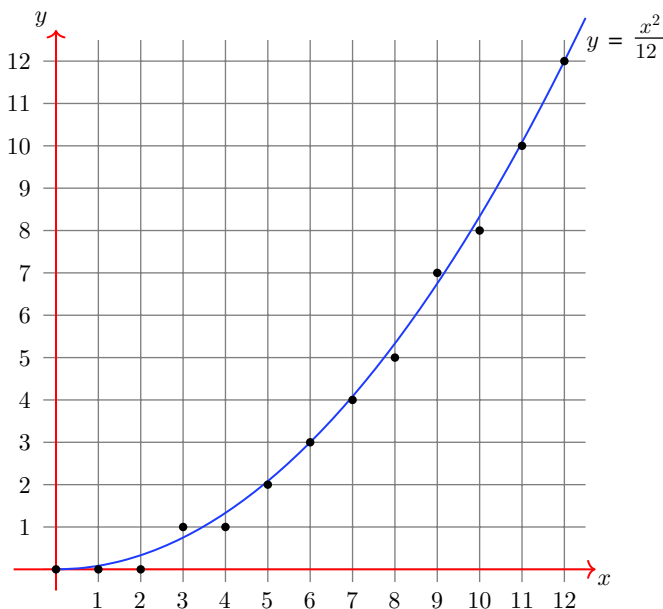


Figure 1. Graph of $y = \frac{x^2}{12}$, with the points (k, e_k) for $0 \leq k \leq 12$.

[†]The recent Numberphile videos on graphing sequences, featuring Neil Sloan of OEIS fame [1], are well worth a watch. For the first, see <https://www.youtube.com/watch?v=pAMgUB51XZA>.

In any case, it is now routine to verify that $e_k = \lfloor \frac{k^2}{12} \rfloor$ satisfies (5). Easiest is to write $k = 6l + r$, where $0 \leq r \leq 5$, whereupon the left- and right-hand sides of $e_{k+3} = e_k + \lfloor \frac{k}{2} \rfloor + 1$ become

$$3l^2 + 3l + lr + \lfloor \frac{r^2+6r+9}{12} \rfloor \quad \text{and} \quad 3l^2 + 3l + lr + \lfloor \frac{r^2}{12} \rfloor + \lfloor \frac{r}{2} \rfloor + 1,$$

respectively. The equality of $\lfloor \frac{r^2+6r+9}{12} \rfloor$ and $\lfloor \frac{r^2}{12} \rfloor + \lfloor \frac{r}{2} \rfloor + 1$ is easily established, case by case, for $r = 0, 1, \dots, 5$.

Honsberger's formula (1) now follows quickly. If $n = 2k$ is even, then $t_n = e_k = \lfloor \frac{k^2}{12} \rfloor = \lfloor \frac{n^2}{48} \rfloor$. If n is odd, then $t_n = t_{n+3} = \lfloor \frac{(n+3)^2}{48} \rfloor$.

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AMSI News

Tim Brown*

The Australian Mathematical Sciences Institute (AMSI) has, as always, been working hard to champion the mathematical sciences in Australia. We aim, not only to strengthen public engagement with mathematics in general, but also to explicitly foster and promote the wealth of skills, knowledge and diversity that women and girls bring to STEM. Driving these goals requires a team effort, so AMSI is very reliant on its ever-increasing partnerships through all our programs.

With two major events occurring in quick succession, the Marketing and Communications team at AMSI has worked diligently to produce exceptional coverage. With 1137 media stories this year and an audience reach of 500 million their hard work continued and campaigning led to two major awards. AMSI won the Best of the Best Award from Universities Australia for the Best Marketing Campaign on a small budget for their APR Intern 'Open Up Your World' campaign. Following this the social media app, Snapchat, also gave a campaign of the month award to Choose Maths with the filter engagement time being twice as long as the average.

APR.Intern and AMSI continued to celebrate and promote the exemplary work of women in STEM Careers and industry with the 'STEMFest: Women Changing Australia' event on 2 September. Hosted by KPMG, the full house event hosted talks and support from influential women of change such as, Catriona Wallace, Founder and Executive Director of Flamingo Ai and Anna-Maria Arabia, Chief Executive at the Australia Academy of Science. APR Intern Director, Gary Hogan, spoke about making very real change and encouraged others to do so, one of the first steps being to sign the STEMFest pledge for diversity and promotion of women in STEM careers.

APR.Intern continue to have a very diverse group of industry partners, recently including Friends of Kings Park in WA, Everbloom, Genetic Signatures, the Victorian Department of Transport and Norske Skog. They also reached a new record with 19 contracts signed in August, bringing the total close to 500 since the start of internships at AMSI and approaching 300 since the start of the Commonwealth Grant in 2017.

The second major AMSI event to occur was the Choose Maths and BHP Foundation Celebration on 10 September. BHP hosted the celebration and its CEO Andrew McKenzie inspired the audience, reflecting on the past five years of the program. He highlighted the significant value it contributes to encouraging mathematics study at school, the need for greater female participation for the future Australian workforce. There were 150 attendees, including the inaugural AMSI

*Australian Mathematical Sciences Institute, Building 161, c/- The University of Melbourne, VIC 3010, Australia. Email: director@amsi.org.au

Scholarship recipient, Gina Rambold-Dent, from Mabel Park State High School in Queensland.

AMSI Schools and Choose Maths continues to shine as they maintain stalls at major careers festivals and expos across Australia such as Townsville, Alice Springs, Canberra, Darwin and the MANSW Conference in New South Wales and the CDAA Nation Conference.

The AMSI Schools Podcast, Maths Talk, is thriving with support from teacher parents and the wider community as seen through engagements with outreach and social media platforms. Episode 5 has recently been released with host, Leanne McMahon, talking with AMSI Schools Outreach Officers, Nadia Abdelel and Marcus Garrett about multiplication and algebraic expansion and factorisation.

Research and Higher Education at AMSI is excited about their upcoming Mahler Lecture Tour, presented in partnership with AustMS. Dr Holly Krieger appears as the guest lecturer for the tour focussing on Mandelbrot sets, the ABC conjecture, transcendence theory and complex dynamics in both public and specialist sessions. The tour takes place in November leading into the AustMS Conference in December.

The University of Sydney returns as the host of AMSI BioInfoSummer from 2–6 December. The speaker line-up includes a mix of international and local talent presenting under the conference themes of epigenetics/genomics, single cell omics, mass spec. analytics and BioCAsia/precision medicine. Professor Rafael Irizarry from Harvard University will present the public lecture on ‘the bright side of applied statistics’.

AMSI Summer School, directed by Dr Yuri Nikolayevsky and held at La Trobe University fast approaches from 6–31 January, 2020. As part of the Summer School AMSI, for the first time, will be presenting an AustMS accredited course, ‘Effective Teaching, Effective Learning in the Quantitative Disciplines’; the course is specifically for those interested in becoming tutors in the mathematical sciences. For more information about Summer School 2020, please visit <https://ss.amsi.org.au>.

Also, as part of a new partnership between AMSI and the Mathematical Sciences Research Institute at Berkeley, AMSI Winter School, 29 June to 10 July 2020 at the University of Queensland will have 20 American student attendees. The event will focus on, ‘New Directions In Representational Theory’. AMSI would like to extend sincere thanks to Event Director, Professor Ole Warnaar, and Scientific Director, Professor Geordie Williamson for putting the program together. More details on the website to come (<https://ws.amsi.org.au>).

Further, AMSI is happy to announce a record number of submissions for Vacation Research Scholarships. The applications are currently being ranked and assessed by the host universities and successful applicants will be announced in the coming weeks.

It has been several months of continuous hard work, challenges and celebrations with many more to come here at The Australian Mathematical Sciences Institute.



Tim Brown has been Director of the Australian Mathematical Sciences Institute (AMSI) since January 2019. Tim was Deputy Vice-Chancellor (Research) at La Trobe as well as Dean of the College of Science at ANU. Tim has been President of the Australian Council of Deans of Science and President of the Statistical Society of Australia. He was previously Head of Mathematics and Statistics, and Foundation Director of the Statistical Consulting Centre, at the University of Melbourne, Professor at the University of Western Australia and also worked at Monash University and the University of Bath. Tim's research interests have been in probability, especially probability approximations and stochastic processes, applied statistics and educational measurement (with applications to Year 12 moderation, scaling and interstate-transfer).



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MAHLER LECTURE TOUR 2019

HOLLY KRIEGER

UNIVERSITY OF CAMBRIDGE

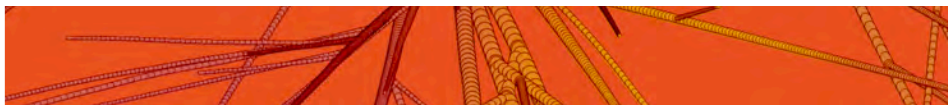
Touring Australian universities
November–December

Lecture topics:

- A tour of the Mandelbrot set
- abc for the working mathematician
- Transcendence and dynamics
- Elliptic curves and complex dynamics
- The mathematics of life

Tour details

RESEARCH.AMSI.ORG.AU/MAHLER-LECTURER



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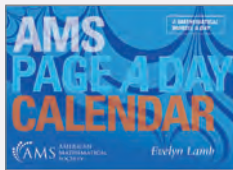
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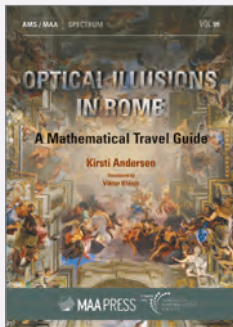


AMS PAGE A DAY CALENDAR

Evelyn Lamb

The *AMS Page a Day Calendar* is a collection of 366 mathematical morsels. Each day features a fun maths fact, a tidbit of maths history, a piece of art made using mathematics, a mathematical puzzle or activity, or another mathematical delight. Topics range from the serious to the silly, from the abstract to the very real. The calendar features mathematics done by people from different races, genders, geographic locations, and time periods.

Nov 2019 372pp 9781470449575 Paperback A\$41.80



OPTICAL ILLUSIONS IN ROME

A Mathematical Travel Guide

Kirsti Andersen, Aarhus University

Translated by Viktor Blåsjo

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Spectrum, Vol. 99

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WHAT'S HAPPENING IN THE MATHEMATICAL SCIENCES, VOLUME 11

Dana Mackenzie

This new volume of *What's Happening in the Mathematical Sciences* features a rich selection of articles about recent topics in pure and applied mathematics.

"Expanding Horizons" and "Needles in an Infinite Haystack" explain new developments in the theory of expander graphs and in number theory (asymptotic Fermat's last theorem), respectively. "The Set® Game Has Met Its Match" presents a solution of the so-called Cap Set Conjecture, a statement about arithmetic progressions in finite vector spaces, which resulted from the mathematical analysis of the popular game "Set".

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MATRIX News

Mathematical Research Institute MATRIX

David Wood*

Australia's residential mathematical research institute MATRIX has recently hosted research programs in PDEs, Functional Data, Representation Theory, Topology, Differential Geometry, Number Theory, Models of Infectious Diseases, Ergodic Theory, Spatial Statistics, Physiological Rhythms, and Conservation Laws. MATRIX will run a mix of programs from across the mathematical sciences in the coming year.

Upcoming programs

- **Structural Graph Theory Downunder**
25 November – 1 December 2019
Organisers: David Wood (Monash), Anita Liebenau (UNSW), Alex Scott (Oxford)
- **Statistical Methods in Data Science**
8–13 December 2019
Organisers: Inge Koch (UWA), Karim Seghouane (Melbourne), Aurore Delaigle (Melbourne), James Ramsay (McGill)
- **Tropical Geometry and Mirror Symmetry**
9–20 December 2019
Organisers: Nick Sheridan (Edinburgh), Brett Parker (Monash), Paul Norbury (Melbourne), Jian He (Monash), Kristin Shaw (Oslo)
- **Early Career Researchers Workshop on Geometric Analysis And PDEs**
13–24 January 2020
Organisers: Paul Bryan (Macquarie), Jiakun Liu (Wollongong), Mariel Sáez (Pontificia Universidad Católica de Chile), Haotian Wu (Sydney)
- **Harmonic Analysis and Dispersive PDEs: Problems and Progress**
3–7 February 2020
Organisers: Zihua Guo (Monash), Ji Li (Macquarie), Kenji Nakanishi (Kyoto), Wenhui Shi (Monash)
- **Spatial Structure In Population Models: Bridging Theory And Data**
20–24 April 2020
Organisers: Matthew Simpson (QUT), Michael Plank (Canterbury), Rachelle Binny (Manaaki Whenua), Maria Bruna (Cambridge)
- **Isoperimetric Inequalities In Geometric Partial Differential Equations**
13–24 July 2020
Organisers: Paul Bryan (Macquarie), Julie Clutterbuck (Monash), Daniel

*MATRIX, Creswick, <http://www.matrix-inst.org.au/>

Hauer (Sydney), Lei Ni (UC San Diego), Guofang Wang (Freiburg), Guofang Wei (UC Santa Barbara)

- **The Skeleton of Turbulent Shear Flows**

14 September – 2 October 2020

Organisers: Philip Hall (Monash), Ivan Marusic (Melbourne), Beverley McKeon (Caltech), Laurette Tuckerman (EPSCI, Paris)

- **Frontiers in Representation Theory**

16–27 November 2020

Organisers: Nora Ganter (Melbourne), Masoud Kamgarpour (Queensland), Peter McNamara (Melbourne), Peng Shan (Tsinghua), Yaping Yang (Melbourne), Gufang Zhao (Melbourne)

- **Groups and Geometries**

30 November – 4 December 2020

Organisers: Alice Devillers (UWA), James Parkinson (Sydney), Jeroen Schillewaert (Auckland), Anne Thomas (Sydney)

- **Hyperbolic Differential Equations in Geometry And Physics**

9–20 December 2020

Organisers: Jesse Gell-Redman (Melbourne), Andrew Hassell (ANU), Todd Oliynyk (Monash), Volker Schlue (Melbourne)

Outreach

As part of our outreach program, MATRIX and ACEMS will host a workshop to equip school teachers to lead MathsCraft events from 20–24 November 2019. Back in schools, the MathsCraft leader poses problems, provokes participants, and organises the sharing of students' ideas. Problems are designed to give an authentic experience of doing mathematical research in a supportive and collaborative environment.

MATRIX Annals

The 2017 *MATRIX Annals*, the second volume in the *MATRIX Book Series*, is now published. The 2018 *MATRIX Annals* is almost complete. These books document scientific activities at MATRIX. The Editors are David Wood (Editor-in-chief), Jan de Gier, Cheryl Praeger, and Terence Tao. Articles can be peer-reviewed, containing original results or reviews on a topic related to the program, or non-peer-reviewed expository articles based on talks or activities at MATRIX.

Submission

Anyone can apply to organise a MATRIX program. Every program should have ample unstructured time to encourage collaborative research. Longer programs can have an embedded conference or lecture series. Short workshops focussing on a special theme are also welcome. The MATRIX Family Fund provides additional support to participants with families.

The MATRIX Scientific Committee selects programs on scientific excellence as well as on the participation rate of high profile international participants and/or business and industry partners, among other criteria.

The next deadline for program proposals in 2020–2021 is

8 November 2019.

The following deadline will be in April or May 2020. Expressions of interest may be submitted at any time. Visit <https://www.matrix-inst.org.au/guidelines> for guidelines.

Organisers are encouraged to supplement their funding from MATRIX through other schemes including: the International Visitor Program of the University of Sydney Mathematical Research Institute; the AMSI and AustMS/ANZIAM workshop funding scheme; and AustMS travel grants.

MATRIX Minors

MATRIX Minor programs are self-funded visits to MATRIX to make use of the available office space and facilities at the Creswick Campus outside program times, for example to work intensively in a small group. Such visits are subject to the approval of MATRIX but can be arranged by sending an email request that briefly outlines the proposed research and timings.

Questions

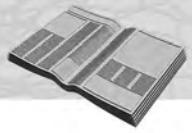
Comments, suggestions and requests are always welcome. Please send these, as appropriate to:

Directors	Jan de Gier (jdg@matrix-inst.org.au) David Wood (davidw@matrix-inst.org.au)
Executive Officer	Sally Zanic (sallyz@matrix-inst.org.au)
Chair of the Advisory Board	Tony Guttmann (guttmann@unimelb.edu.au)

MATRIX is a partnership between Monash University and The University of Melbourne, with the ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS) as an associate member.



Professor Wood's research interests lie in discrete mathematics, especially structural graph theory, extremal graph theory, graph colouring, and combinatorial geometry. He is an Editor-in-Chief of *The Electronic Journal of Combinatorics*, and is an editor of *Journal of Computational Geometry*, *Journal of Graph Theory*, and *SIAM Journal on Discrete Mathematics*. He is a former President of the Combinatorial Mathematics Society of Australasia.



The Sydney Mathematical Research Institute

Anthony Henderson*

November 2019 marks a year since the official launch of SMRI, and six months since the opening of our offices in the University of Sydney's Quadrangle building and the hosting of our first international visitors. We have celebrated these milestones in Sydney with the public lectures mentioned in my last report, while SMRI Director Geordie Williamson has passed another milestone of his own, becoming the first mathematician working at an Australian university to speak in the prestigious annual 'Current Developments in Mathematics' conference at Harvard University.

By the end of 2019, that is, in the first eight months of our operations, SMRI will have hosted 22 visiting researchers funded through our International Visitor Program, as well as over 40 other mathematical scientists who were in Sydney for different reasons and generally for shorter periods. As a result of the record number of applications we have approved in the July 2019 round of the International Visitor Program (listed below), combined with previous rounds, we now have 38 IVP visitors lined up for the calendar year 2020, with more still to be selected for the latter months. As well as forming the basis for a vibrant research atmosphere in the University of Sydney itself, these 2020 SMRI IVP visitors will be spending more than 50 months in total at other Australian universities, giving plenary lectures in the annual ANZIAM and AustMS conferences, and participating in workshops at MATRIX and elsewhere. In addition, as announced by AMSI earlier this year, SMRI is now able to fund some of the international speakers in workshops selected through the AMSI/AustMS funding scheme. It is pleasing to see that the philanthropic vision behind SMRI is truly having a national impact.

Applications are currently being received for the fourth round of the International Visitor Program, with a deadline of 27 January 2020, which is for visits taking place in the period October 2020 – June 2021. See the website <https://sydney.edu.au/smri> for the terms and conditions and the application form. Once again, I urge all AustMS members to spread the word about this program among their international contacts and collaborators. We particularly welcome applications from female and gender-diverse researchers, as well as researchers belonging to other groups which are underrepresented in the mathematical sciences.

*Sydney Mathematical Research Institute, University of Sydney.
Email: anthony.henderson@sydney.edu.au

International Visitor Program – July 2019 round**Successful Applicants¹**

Sydney Mathematical Research Institute acknowledges the valuable contributions (financial and otherwise) to the International Visitor Program made by the School of Mathematics and Statistics at the University of Sydney and by the hosts and universities listed below.

Nancy Reid (University of Toronto)

Research interests: Theoretical statistics, statistical inference, likelihood methods, asymptotic theory of statistics, foundations of inference, interface between statistics and data science, applications of statistical theory

Dates:

20 January – 5 February 2020, 7–20 April 2020 (University of Sydney, *Host:* Samuel Mueller)

6 February – 27 March 2020 (Monash University, *Host:* Di Cook)

28 March – 6 April 2020 (University of Melbourne, *Host:* Aurore Delaigle)

Bob Rink (Vrije Universiteit Amsterdam)

Research interests: Dynamical systems, bifurcation theory, equivariant dynamics, coupled cell networks, synchronization, coupled oscillators, Hamiltonian systems, KAM theory, Aubry Mather theory, monotone recurrence relations

Dates:

3 February – 1 July 2020 (University of Sydney, *Host:* Martin Wechselberger)

Sandro Vaienti (University of Toulon)

Research interests: Statistical properties of dynamical systems, decay of correlations, limit theorems, non-uniformly hyperbolic dynamical systems, random perturbations of dynamical systems, extreme value theory

Dates:

1–15 April 2020 (University of New South Wales, *Host:* Gary Froyland)

16–30 April 2020 (University of Sydney, *Host:* Georg Gottwald)

1–10 May 2020 (University of Queensland, *Host:* Cecilia Gonzalez-Tokman)

Changfeng Gui (University of Texas at San Antonio)

Research interests: Nonlinear partial differential equations arising from geometric analysis and physical sciences

Dates:

1 April – 31 May 2020 (University of Sydney, *Host:* Daniel Hauer)

Enrique Pardo Espino (Universidad de Cádiz)

Research interests: Algebras associated to combinatorial structures: graphs, self-similar actions, inverse semigroups, groupoids and small categories

¹Dates are as of 30 September 2019 and are subject to change. For updated information see the SMRI webpage.

Dates:

12 April–9 May 2020 (University of Wollongong, *Host:* Aidan Sims)
 10–23 May 2020 (University of Newcastle, *Host:* Alejandra Garrido Angulo)
 24 May–6 June 2020 (University of Sydney, *Host:* Nathan Brownlowe)

Valery Alexeev (University of Georgia)

Research interests: Algebraic geometry, including moduli spaces, birational geometry, minimal model program, combinatorial algebraic geometry, algebraic groups

Dates:

25 April–2 May 2020 (Australian National University, *Host:* Anand Deopurkar)
 3–25 May 2020 (University of Sydney, *Host:* Anthony Henderson)

Matteo Burzoni (ETH Zurich)

Research interests: Financial mathematics, economics, stochastic analysis, game theory, PDE

Dates:

25 May–5 July 2020 (University of Sydney, *Host:* Anna Aksamit)

Vladimir Dragović (University of Texas at Dallas)

Research interests: Integrable systems, Painlevé and Schlesinger equations, billiards, rigid body systems, extremal polynomials, Riemann surfaces

Dates:

1–30 June 2020 (University of Sydney, *Host:* Milena Radnović)

Mariusz Urbański (University of North Texas)

Research interests: Ergodic theory and dynamical systems, conformal dynamical systems, holomorphic dynamical systems, random dynamical systems, iterated function systems, thermodynamic formalism, Kleinian groups, gas lattices, statistical physics

Dates:

1–14 June 2020 (University of Sydney, *Host:* Alexander Fish)
 15 June–31 July 2020 (University of New South Wales, *Hosts:* Gary Froyland and Jason Atnip)

Jiuzu Hong (University of North Carolina at Chapel Hill)

Research interests: Representation theory, algebraic geometry

Dates:

1 June–31 July 2020 (University of Sydney, *Host:* Oded Yacobi)

Johannes Schleischitz (Middle East Technical University)

Research interests: Diophantine approximation, transcendence theory, lattices, homogeneous dynamics, geometry of numbers, uniform distribution, mass theory

Dates:

15 June–15 July 2020 (University of Sydney, *Host:* Dmitry Badziahin)
 16 July–15 August 2020 (La Trobe University, *Host:* Mumtaz Hussain)

Lisa Orloff Clark (Victoria University of Wellington)

Research interests: Functional analysis and operator algebras, topological groupoids and their associated algebras, connections between functional analysis and ring theory

Dates:

1–15 July 2020 (University of Sydney, *Host:* Nathan Brownlowe)

15 July – 12 August 2020 (University of Wollongong, *Host:* Aidan Sims)

Vidit Nanda (University of Oxford)

Research interests: Applied and computational algebraic topology, Morse theory, constructible sheaves and stacks on stratified spaces

Dates:

1 July – 1 September 2020 (University of Sydney, *Host:* Yusra Naqvi)

2 September – 1 October 2020 (Australian National University, *Host:* Katharine Turner)

Hung Tran (University of Oklahoma)

Research interests: Geometric group theory, low-dimensional topology

Dates:

6 July – 15 August 2020 (University of Sydney, *Host:* Anne Thomas)

Kenneth Ascher (Princeton University)

Research interests: Moduli of higher dimensional algebraic varieties, birational geometry, K-stability, applications to arithmetic

Dates:

13 July – 14 August 2020 (University of Sydney, *Host:* Behrouz Taji)

Holger Waalkens (University of Groningen)

Research interests: Dynamical systems, Hamiltonian systems, integrable systems, mathematical physics, semiclassics, optics

Dates:

20 July – 20 September 2020 (University of Sydney, *Host:* Holger Dullin)

Alex Townsend (Cornell University)

Research interests: Spectral methods, low rank approximation, orthogonal polynomials, fast transforms, multilinear algebra

Dates:

3–18 August 2020 (University of Sydney, *Host:* Geoffrey Vasil)

19 August – 2 September 2020 (University of New South Wales, *Host:* Frances Kuo)

Ágnes Cseh (Hungarian Academy of Sciences)

Research interests: Discrete mathematics, graph theory, graph algorithms, complexity theory, matchings under preferences

Dates:

16 August – 11 September 2020 (University of Sydney, *Host:* Julian Mestre)

12–26 September 2020 (University of New South Wales, *Host:* Haris Aziz)

Péter Koltai (Freie Universität Berlin)

Research interests: Theoretical, numerical, and efficient data-based analysis and modelling of complex, chaotic, multiscale, and stochastic systems

Dates:

17–30 August 2020 (University of Sydney, *Host:* Georg Gottwald)

31 August – 26 September 2020 (University of New South Wales, *Host:* Gary Froyland)

Yongsheng Zhang (Tongji University)

Research interests: Calibrated geometry, minimal submanifolds

Dates:

1 September – 30 October 2020 (University of Sydney, *Host:* Haotian Wu)

Shamik Gupta (Ramakrishna Mission Vivekananda Educational and Research Institute)

Research interests: Equilibrium and nonequilibrium statistical mechanics, stochastic processes, nonlinear dynamics, quantum dynamics

Dates:

1 November – 15 December 2020 (University of Sydney, *Host:* Eduardo Altmann)

Jonathan James Wylie (City University of Hong Kong)

Research interests: Fluid mechanics, partial differential equations, mathematical models for ion transport

Dates:

2–8 November 2020 (University of Adelaide, *Host:* Yvonne Stokes)

9–13 November 2020 (University of South Australia, *Host:* Bronwyn Hajek)

14–28 November 2020 (University of Sydney, *Host:* Martin Wechselberger)

Elena Issoglio (University of Leeds)

Research interests: Stochastic analysis with strong links to the theory of PDEs

Dates:

9 November – 1 December 2020 (University of Sydney, *Host:* Benjamin Goldys)

2–9 December 2020 (University of New South Wales, *Host:* Thanh Tran)

Tiziano De Angelis (University of Leeds)

Research interests: Optimal stopping, singular stochastic control, free boundary problems, stochastic games and mathematical finance

Dates:

9 November – 9 December 2020 (University of Sydney, *Host:* Anna Aksamit)

Jeroen Schillewaert (University of Auckland)

Research interests: Tits buildings and related areas

Dates:

15–28 November 2020, 4–18 December 2020 (University of Sydney, *Host:* Anne Thomas)

28 November – 4 December 2020 (MATRIX)

Henri Berestycki (Université Paris Sciences et Lettres)

Research interests: Calculus of variations, qualitative theory of nonlinear elliptic and parabolic equations, free boundary problems, propagation phenomena, mathematical models in physics, biology, ecology, and social sciences

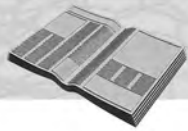
Dates:

20 November – 4 December 2020 (University of Sydney, *Host:* Daniel Daners)

4–20 December 2020, including AustMS Annual Meeting (University of New England, *Host:* Yihong Du)



Anthony Henderson is currently the Executive Director of the University of Sydney Mathematical Research Institute, which he helped to establish in 2018. After obtaining his PhD from the Massachusetts Institute of Technology in 2001, he returned to the University of Sydney as a postdoctoral researcher and has worked there ever since. For his publications in geometric and combinatorial aspects of representation theory, Anthony was awarded the Christopher Heyde Medal in 2011 and the Australian Mathematical Society Medal in 2012. He also received a Faculty of Science Citation for Excellence in Teaching in 2009, and his Honours-level lecture notes on Lie algebras were published by Cambridge University Press in 2012. He is a founding Director of the Simon Marais Mathematics Competition for undergraduates in the Asia-Pacific region.



News

General News

Mathematics in the media

The ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS) is proud to announce the release of Season 2 of its podcast, The Random Sample. The aim of The Random Sample is to open up the world of the mathematical sciences to a whole new audience by showcasing interesting maths and stats research, as well as exploring issues of importance. The first four episodes for Season 2 are available:

- “Matilda to the rescue”: Professor Kate Smith-Miles talks about the issue of trust when it comes to algorithms, and what her team has created to really ‘stress-test’ algorithms.
- “Weighing up evidence in criminal courts and at a king’s burial site”: Professor David Balding explores the use of statistical genetics in the legal system, and in identifying the remains of a medieval king.
- “MARVEL-lous casting”: Professor Matt Roughan shows how he’s using maths to help explain the popularity of the Marvel Comics Universe.
- “A day can make a difference”: Dr Amie Albrecht, Dr Melissa Humphries, and Dr Rachael Quill talk about the successful ‘Women In Maths’ Day event held in Australia this year. What has come of it, and what’s ahead when it comes to the issue of gender equity in the mathematical sciences. You can subscribe for free to the podcast by searching for ‘The Random Sample’ wherever you get your podcasts. New episodes will come out on Wednesdays. To find out more about The Random Sample, head to the ACEMS website: [ACEMS.org.au/podcast](https://www.acems.org.au/podcast).

Also, if you think you have a topic of interest for the podcast, please contact ACEMS Communications Officer Tim Macuga: timothy.macuga@qut.edu.au

Women in Mathematics

RMIT University

Celebrating the first ever Women in Mathematics Day, on 12 May in honour of the birthday of Maryam Mirzakhani, the first female Fields Medallist. The School of Mathematical sciences hosted this event and we celebrated the occasion on 15 May at 2:30 to 3:30 in Room 66, Level 9, Building 8, RMIT University. We had a great panel discussion with Professor Asha Rao, Professor Irene Hudson and Professor Belinda Tynan. The organizer, Laleh Tafakori, talked about the importance of 12 May, “who is organizing May 12 events?” and briefly about Maryam Mirzakhani’s achievements. Then, she asked panel members to focus on their careers, including challenges they have had along the way and any tips for working as a successful woman in an academic area. Furthermore, panel members discussed the questions provided by attendees.

The participants were academic staff and students from their final year of undergraduate studies through to PhD, as well as early-career researchers, from different schools and universities. We believe that these kinds of networking events have a large part to play in encouraging young women to continue in their mathematical careers. Furthermore, participants had this chance to know about the experience of professionals who overcame their career obstacles. So, it was a great opportunity, especially for women, to believe in themselves more than before.

University of New South Wales

The School of Mathematics and Statistics at UNSW Sydney hosted the 15th annual Girls Do the Maths workshop on 20 September. The event attracted over 120 female high school students from 15 schools across New South Wales.

Mathematics Competitions

On 13 September the School of Mathematics and Statistics of the University of New South Wales held a prize-giving ceremony to award high-achieving students who competed in the UNSW 58th Annual School Mathematics Competition; 779 school students sat the examination throughout NSW and the ACT in June.

In early September, UNSW's Data Science Society DataSoc ran a competition jointly with Tsinghua University's Institute of Data Science, seeking to unite and foster growing international talent in the rapidly evolving field of data science. Six teams from UNSW and Tsinghua University spent an intense two days hacking their way through a complex data science challenge, presenting their solution to a panel of experts at Atlassian.

Completed PhDs

Federation University Australia

- Dr Samuel Bell, *Tropical cyclone tracks in CMIP5 models: statistical assessment and future projections*, supervisors: Savin Chand and Chris Turville.

Griffith University

- Dr Dilan Pathirana, *Numerical modelling of blood flow for coarctation of the aorta: pre- and post-treatment simulations*, supervisors: Peter Johnston and Barbara Johnston.

Queensland University of Technology

- Dr Brigitte Colin, *Prediction of noisy spatial data using boosted regression trees*, supervisor: Kerrie Mengersen.
- Dr Tristan Reddan, *Still haven't found what you're looking for: ultrasound of appendicitis in children and the value of secondary sonographic signs*, supervisors: Kerrie Mengersen, Wenbiao Hu, Fiona Harden, and Jonathan Corness.

Swinburne University of Technology

- Dr Fatemeh Ansarizadeh, *Modelling of tumour cells regression in response to electromagnetic therapy and chemotherapeutic treatment*, supervisors: Tonghua Zhang, Manmohan Singh and David Richards.

University of New South Wales

- Dr Adam Mammoliti, *On matching sequencibility, the Erdős–Ko–Rado theorem and other unrelated stuff*, supervisor: Thomas Britz.

University of New South Wales Canberra

- Dr Smaila Sanni, *Optimal policies in deterministic and stochastic inventory models: theory and applications*, supervisors: Zlatko Jovanoski, Harvinder Sidhu and Ben O'Neill.

University of Newcastle

- Dr Muhammad Ilyas, *Finite element methods and multi-field applications*, supervisors: Bishnu Lamichhane and Mike Meylan.

University of Sydney

- Dr Becky Armstrong, *Simplicity of twisted C^* -algebras of topological higher-rank groups*, supervisor: Nathan Brownlowe.
- Dr Timothy Bywaters, *Connections between Willis' theory for totally disconnected locally compact groups and graph automorphisms*, supervisor: Jacqui Ramagge.
- Dr Sean Carnaffan, *Anomalous diffusion processes: stochastic models and their properties*, supervisor: Ray Kawai.
- Dr Adrienne Jenner, *Applications of mathematical modelling in oncolytic virotherapy and immunotherapy*, supervisor: Peter Kim.

University of Western Australia

- Dr Kassel Hingee, *Spatial statistics of random closed sets for earth observations*, supervisors: Gopal Nair, Adrian Badedeley and Peter Caccetta.

Awards and other achievements

Australian National University

- Associate Professor Barry Croke has been appointed as the International Union of Geodesy and Geophysics national representative to the International Association of Hydrological Sciences. This appointment was made through the Australian Academy of Science for the 2019–2023 term.

Griffith University

- Dr Dilan Pathirana has been awarded a 2019 Australian Mathematical Society Lift-off Fellowship.

Queensland University of Technology

- Dr Roby Araujo has been awarded an ARC Future Fellowship: FT190100645 The Systems Biochemistry of Adaptation in Cellular Protein Networks.

Swinburne University of Technology

- The Australian newspaper's 2019 Research magazine names Swinburne researcher Associate Professor Tonghua Zhang as a recognised leader in his field (Applied Mathematics), and the university as a leading institution in several fields including mathematics.

University of the Sunshine Coast

- Lauren Thornton won the Gordon Preston prize, awarded annually for the most outstanding student talk at the Australian Algebra Conference.

University of Sydney

- Lamiae Azizi was awarded the University of Sydney – University of Edinburgh Partnership Collaboration Award.
- Sally Cripps, Emi Tanaka and Lamiae Azizi were awarded an ARC grant to establish DARE, an Industrial Transformation Training Centre for Data Analytics for Resources and Environments.
- Pengyi Yang was been awarded an Emerging Leadership Level 2 Investigator Grant by the NHMRC.
- Nalini Joshi AO was awarded a Bragg Membership of the Royal Institution of Australia, and the NSW Premier's Prize for Excellence in Mathematics.

University of Western Australia

- Calum Braham was awarded a Rhodes Scholarship and is now working with the Industrial Mathematics Group in Oxford. He will submit his MPhil thesis shortly (supervisors, Nev Fowkes, Brendon Florio, David Walker, Michael Small). He worked for the Oceans Research Institute for a month before leaving for Oxford.
- Conway Li was awarded a Fenton Pillow fellowship which supplements his travel to conferences. He was also awarded 'best presentation by a student' at the ANZIAM meeting this year.
- Enrico Valdinoci has been awarded a Laureate Fellowship, for his project 'Minimal surfaces, free boundaries and partial differential equations'.

- Alexander Bors was awarded the 2018 Kirkman Medal of the Institute of Combinatorics and its Applications. Kirkman Medals recognize excellent research by Fellows or Associate Fellows of the ICA early in their research career, as evidenced by an excellent body of published research.
-

Appointments, departures and promotions

Australian National University

- Simon Kitson has been appointed as a Kick-Start Fellow at MSI, commencing 8 October 2019.

Griffith University

- Dr David Harman has taken up a one-year contract as Associate Lecturer, commencing July 2019.

Monash University

- Dr Adam Mammoliti is now a postdoc at Monash University, working with Daniel Horsley and Ian Wanless.

Queensland University of Technology

- Dr Robyn Araujo has been promoted to Senior Lecturer.
- Prof Troy Farrell is stepping down as the Head of School as he has been appointed Deputy Dean of the Science and Engineering Faculty.
- Dr Helen Thompson is acting Head of School until a new Head of School is appointed.

Royal Melbourne Institute of Technology

- Associate Professor John Shepherd retired in July 2019.
- Dr Lynne McArthur resigned from RMIT recently.

University of Adelaide

- Dr Benjamin McMillan, from the University of Stony Brook, has joined the school as an ARC Research Associate working with Dr Thomas Leistner.

University of New South Wales

- Dr Minh Dao, formerly at the University of Newcastle, joined the School of Mathematics and Statistics of UNSW Sydney as a postdoc working with A/Prof Guoyin Li.

University of New South Wales Canberra

- Tim Trudgian was promoted to Associate Professor, effective 1 January 2020.

University of Southern Queensland

- Mr Daniel Burrell has joined USQ as a Statistics lecturer and Biometrician.

University of the Sunshine Coast

- Lauren Thornton has been appointed as Associate Lecturer in Mathematics in the School of Science & Engineering.

University of Western Australia

- Ayham Zaitouny and Debora Correa have been appointed as research fellows in the ARC Industrial Transformation Training Centre for transforming Maintenance through Data Science www.maintenance.org.au.
- Anurag Bishnoi will join the CMSC in November on a DECRA fellowship.

New Books

University of Western Australia

Carbotti, A., Dipierro, S. and Valdinoci, E. (2019). *Local Density of Solutions to Fractional Equations*. De Gruyter Studies in Mathematics **74**. ISBN: 978-3-11-066435-5. <https://www.degruyter.com/view/product/534026>

Conferences and Courses

Conferences and courses are listed in order of the first day.

*For information about MATRIX programs,
see the report by David Wood in this issue.*

The Third Australian Algebra Conference (AAC03)

Dates: 30 November to 1 December 2019

Venue: RMIT in Melbourne

Web: <https://aac3.ltumathstats.com/>

This takes place on the weekend before the start of the AustMS annual conference, leaving one rest day between the two conferences. Registration for the Third Australian Algebra Conference, AAC03, is now open for everyone, via the AustMS website: https://register.austms.org.au/sys/registration/identity.php?conf_id=47.

This conference is actually the 38th iteration of an annual conference which for many years was called the Victorian Algebra Conference. Over the years it has become increasingly national, both in participation and location, and this is reflected in the new name.

The main aim of the annual Australian Algebra Conference is to foster communication between algebraists in Australia. We interpret algebra quite broadly, including areas such as topological algebra, algebraic logic, graph theory and coding theory.

The conference has a proud tradition of encouraging talks by students: typically about one third of the talks are presented by students. The conference aims to provide graduate students in algebra with the opportunity to give their first public presentation in a relaxed and supportive environment. Each conference, the most outstanding student talk is awarded the Gordon Preston Prize.

For more details contact Graham Clarke (g.clarke@rmit.edu.au) or one of the other organisers listed on the conference website.

Sixty-third annual meeting of the Australian Mathematical Society

Dates: Tuesday 3 to Friday 6 December 2019

Venue: Monash University

Web: <http://staging.austms.org.au/annualmeeting/2019/>

Registration has now closed.

Fourth Workshop on Metric Bounds and Transversality

Dates: 8–10 December 2019

Venue: Swinburne University, Melbourne

Web: <https://www.wombat.rmitopt.org/>

Registration is still open at the website.

Data Science Down Under

Dates: Sunday 8 December to Thursday 12 December

Venue: Newcastle

Web: <https://carma.newcastle.edu.au/meetings/dsdu/#page=about>

For further details, see *Gazette* 46(4), p. 241.

42nd Australasian Conference on Combinatorial Mathematics and Combinatorial Computing

Dates: 9–13 December 2019

Venue: University of New South Wales, Sydney

Web: <https://conferences.maths.unsw.edu.au/e/42accmcc>

For further details, see *Gazette* 46(4), pp. 241–242.

Finite Geometry: A Workshop in Honour of Tim Penttila

Dates: 16–17 December 2019

Venue: The University of Adelaide

Web: <https://penttilafest.wordpress.com/>

For further details, see *Gazette* 46(4), p. 242.

NZMRI summer meeting

Dates: 13–19 January 2020

Venue: Tahuna Beach, Nelson

Web: <http://sms.victoria.ac.nz/Events/AotearoaGR2020/WebHome>

The topic of the 2020 NZMRI summer meeting will Mathematics of General Relativity, with lectures starting on Tuesday 14th and finishing at lunchtime on Sunday 19th.

We have three great speakers confirmed (Edward Witten, Clifford Taubes, Piotr Chrusciel) with more to be announced.

The meeting website includes a registration form. Please register as soon as possible.

Please note that we are not booking accommodation for academics for this meeting. The website has links to some local hotels. Nelson is a popular holiday destination, so we suggest that you book soon.

2020 Mathematics in Industry Study Group (MISG)

Dates: Tuesday 28 January to Saturday 1 February 2020

Venue: NewSpace, University of Newcastle's City Campus

Web: <https://mathsinindustry.com/>

Registration is free for participants and is now open. Please feel free to pass on this information to others who may not be members of ANZIAM or AustMS. Enquiries about MISG 2020, contact: misg@newcastle.edu.au.

AMSI-ANZIAM Early-Career Workshop (ECW)

Dates: Saturday 1 (approx. 1pm start) and Sunday 2 February 2020

Venue: Crowne Plaza, Hunter Valley

Web: <http://www.maths.mq.edu.au/ANZIAM2020/>

This workshop will be held immediately before ANZIAM 2020. Registration is free and is open to all current students and conference delegates within five years of graduating. The ECW also includes dinner on the evening of the 1st and lunch on the 2nd, with tea provided both days. Registration for the ECW is available as part of the registration for ANZIAM 2020 at the link above.

ANZIAM2020

Dates: Sunday 2 to Thursday 6 February 2020

Venue: Crowne Plaza Resort, Hunter Valley, New South Wales

Web: <http://www.maths.mq.edu.au/ANZIAM2020/>

Registration and abstract submissions is now open. The deadline for receipt of abstracts is 13 December 2019. Get your abstract in early and avoid disappointment. Support for student participation at the conference is available through the ANZIAM Student Support Scheme (full details at www.anziam.org.au/The+ANZIAM+Student+Support+Scheme).

Please feel free to pass on this information to others who may not be members of ANZIAM or AustMS.

For regular updates, follow ANZIAM2020 on Twitter: @anziam2020

New Connections in Representation Theory

Dates: 10–14 February 2020

Venue: Mantra Hotel Conference Centre, Mooloolaba, Queensland

Web: <https://sites.google.com/view/mooloolaba2020/home>

A list of speakers and additional information is available at the conference website.

Monash Worskhop on Numerical Differential Equations and Applications

Dates: 10–14 February 2020

Venue: Monash University

Web: <http://users.monash.edu/~jdroniou/MWDEA/>

The goal of this workshop is to bring together researchers developing, analysing or using numerical methods for differential equations. Topics covered will include, but are not limited to: equations with random input, finite element methods, high-order schemes, adaptative methods, non-linear problems, sparse grids, Monte-Carlo methods, Bayesian computations, linear solvers, and various applications (fluid-structure interactions, chemistry, biology, . . .), etc. The workshop will have keynote presentations and contributed talks. Full details can be found on the webpage.

Registrations are open, with a deadline of 10 January 2020, and is free for everybody (students as well as non-students). In addition to morning and afternoon teas, lunches will be provided every day of the workshop, and a barbecue will be organised one of the evenings.

Support is available for PhD students and postdocs. Up to half the travel/accommodation expenses (max. \$400 for domestic, \$800 for international) can be covered for students who participate in the workshop. The details and application form are on the webpage: <http://users.monash.edu/~jdroniou/MWDEA/>. The deadline for requesting support is 31 December.

Organisers: Santiago Badia and Jerome Droniou.

Symmetries of Discrete Objects

Dates: 10–14 February 2020

Venue: Rotorua, New Zealand

Web: www.math.auckland.ac.nz/~conder/SODO-2020

Rotorua is a scenic and interesting city about three hours drive (or a 45-minute flight) south of Auckland. It's also close to 'Hobbiton', used for the Hobbit and Lord of the Rings movies: in fact, it was the venue for the 41ACCMCC in 2018.

The conference theme is broad, and includes symmetries of graphs, maps, polytopes, Riemann/Klein surfaces, and other discrete structures such as block designs and finite geometries, with theory and applications of groups as a common thread.

The first two of these conferences were held at Queenstown (NZ) in 2012 and 2016.

So far, the confirmed invited keynote speakers include

- Anneleen De Schepper (Ghent University, Belgium) Dimitri Leemans (Université Libre de Bruxelles, Belgium)
- Joy Morris (University of Lethbridge, Canada)
- Primož Potocnik (University of Ljubljana, Slovenia)
- Jozef Širáň (Open University, UK, and Slovak University of Technology, Slovakia).

If you are interested in attending, please register by **early**. Registration fees do not have to be paid until 4 January 2020, but we need to have a good idea of participant numbers well before then.

Aboriginal and Torres Strait Islander Mathematics Alliance 2020 Conference

Dates: 27–30 July 2020

Venue: Yirrkala, Northeast Arnhem Land

Web: <https://atsimanational.ning.com/atsima-2020-yirrkala>

ATSIMA 2020 will be held in Yirrkala an Indigenous Community in Arnhem Land, in the Northern Territory, 18 km south-east from the large mining town of Nhulunbuy. ATSIMA together with Yirrkala Bilingual School will work in collaboration. This opportunity to attend a conference right in the middle of where culture and mathematics is being taught is not to be missed.

If you would like to work in collaboration with ATSIMA and Yirrkala School please contact Melinda Pearson (melindapearson@atsima.org).

64th Annual Meeting of the Australian Mathematical Society (AustMS 2020)

Dates: Tuesday 8 December 2020 to Friday 11 December 2020

Venue: University of New England, Armidale, NSW

Contact: Gerd Schmalz (schmalz@une.edu.au)

Vale

Dr Barbara Susanna (Susan) Niven

Dr Barbara Susanna (Susan) Niven passed away on 3 September 2019. Susan came to Australia from South Africa, via the United Kingdom, in 1963, and was a Lecturer at the University of Western Australia and Senior Lecturer at the University of Adelaide until 1979. She was then at Griffith University until her retirement

in 1993. She joined the Australian Mathematical Society soon after arriving in Australia, and was active in founding the WA Statistical Society (later a branch of the Statistical Society of Australia) and the South Australian Branch of the SSAI. She worked closely with a number of ecologists, formalizing axiomatically of the definition of an ecosystem, and integrated more mathematical precision into undergraduate courses in zoology.

Visiting mathematicians

Visitors are listed in alphabetical order and details of each visitor are presented in the following format: name of visitor; home institution; dates of visit; principal field of interest; principal host institution; contact for enquiries.

Information in this section is complemented by Anthony Henderson's report from the Sydney Mathematical Research Institute.

- Dominik Bernhardt; RWTH Aachen; 5 September 2019 to 20 January 2020; UWA;
Cheryl Praeger
- Prof Dietmar Bisch; Vanderbilt University; 2–10 February 2020; operator algebras; UNSW Sydney; Arnaud Brothier
- Miaomiao Cai; Dalian University of Technology; September 2019 to September 2020; UWA; Enrico Valdinoci and Serena Dipierro
- A/Prof Jian Chen; Foshan University, China; applied and computational mathematics; 1 March 2019 to 1 March 2020; QUT; Fawang Liu
- A/Prof Yongsheng Cheng; University of Science and Technology of China; 25 August 2019 to 28 February 2020; Lie theory closely related affine Kac–Moody algebras; USN; Ruibin Zhang
- Prof Daryl Cooper; University of Santa Barbara USA; 1 September to 15 December 2019; USN; Stephan Tillmann
- Dr Christopher Doris; University of Bristol; 4 November to 13 December 2019 and 1–28 February 2020; handling precision in p-adic ring computations and parallelisation of mathematical algorithms; USN; John Cannon
- Dr Hongmei Hu; 1 September 2019 to 31 August 2020; degenerate quantum groups associated with finite dimensional and affine Lie algebras; USN; Ruibin Zhang
- Dr Zahir Hussain; MMU UK; 16–20 December 2019; nonlinear asymptotic stability methods for boundary layer fluid flow in complex geometries; USN; Sharon Stephen
- Ashleigh Hutchinson; University of Witwatersrand; November 2019; UWA
- Prof Alexander Ioffe; Technion; December 2019; optimization; UNSW; Vera Roshchina
- Dr Sebastian Klein; University of Mannheim; 18 November to 17 December 2019; soul curves of a class of constant mean curvature tori; USN; Emma Carberry
- Prof Weidong Liu; Shanghai Jiao Tong University; 20 January to 14 February 2020; multivariate cointegrating regression; USN; Qiying Wang
- Prof Marco Lopez; University of Alicante; December 2019; optimization; Deakin; Julien Ugon

- Dr Bruno Lourenço; University of Tokyo; 2–17 November 2019; convex geometry and optimisation; UNSW; Vera Roshchina
- Ms Sayantika Mondal (FRT scholar); 28 May to 31 March 2020; ANU; Joan Licata
- Dr Vidit Nanda; Oxford University; 18 September 2018 to 30 June 2021; applied algebraic topology; USN; Jacqui Ramagge
- Prof Alice Niemeyer; RWTH Aachen, Germany; July to December 2019; CMSC
- Dr Syarifah Zyurina Nordin; 1 July to 20 December 2019; task scheduling in parallel processors; USN; Anthony Henderson
- Prof Jan Obloj; 12 August to 20 December 2019; quantification of the value of information in the robust approach to pricing and hedging problems; USN; Anna Aksamit
- Lihong Qiu; Xi'an Jiaotong University; 1 September 2019 to 31 August 2020; UWA; Gordon Royle
- Michael Rehme; University of Stuttgart; 16 September to 20 December 2019; ANU; Steve Roberts
- Dr Nir Sharon; Tel-Aviv University; November to December 2019; approximation; SUT; Nadezda Sukhorukova
- A/Prof Ayesha Sohail; University of Lahore; 8–17 January 2020; fluids, nanofluids, deterministic and stochastic dynamical systems; USN; Peter Sehoon Kim
- Tim Stokes; University of Waikato; 25–29 November 2019; semigroups; WSU; James East
- Mr Leon Surel; 25 November to 20 December 2019; theory of discrete Painlevé equations and integrable lattice equations; USN; Nalini Joshi
- Prof Yundong Tu; University of Peking; 7 January to 6 February 2020; non-linear co-integrating regressions with endogeneity; USN; Qiying Wang
- Dong Wang; Harbin Institute of Technology; 19 September 2019 to 18 March 2020; UWA; Michael Small
- Prof Robert Wilson; Queen Mary University of London; 6 November to 20 December 2019; finite groups and simple finite groups; USN; John Cannon
- Dr Siti Ainor Mohd Yatim; Universiti Sains Malaysia; 7 February 2019 to 6 February 2020; numerical simulation and numerical analysis of ordinary and partial differential equations; USN; Peter Sehoon Kim
- Hui Zhang; Jinling Institute of Technology; 14 October 2019 to 15 October 2020; UWA; Enrico Valdinoci and Serena Dipierro
- Jing Zhang; China University of Mining and Technology; September 2019 to November 2020; UWA; Michael Small
- Dr Jingkui Zhang; Qingdao University of Technology; 30 March 2019 to 29 March 2020; ANU; Matthew Hole
- Mr Yihan Zhou; University of Glasgow; 16 September to 15 November 2019; real options and optimal stopping under non-linear expectations with applications to resources and investments; USN; Marek Rutkowski
-



Elections for President-elect and one Ordinary Member position on Council

Nominations for the office of Incoming-President of the Australian Mathematical Society:

Prof Ole Warnaar
A/Prof Lesley Ward

Nominations to Council of the Australian Mathematical Society:

A/Prof Mark Holmes
Dr Marcy Robertson

Ballots and information on how to vote have been sent to eligible voters. Due date for submission of ballots is 25 November.

Reminder of the Society's Annual General Meeting

The Society's 63rd Annual General Meeting will be held on Thursday 5th December at Monash University, during the Society's annual conference. The agenda and papers for the meeting will be posted on the conference website about a week before the meeting.

Reminder of Special Interest Meeting deadline

The next application deadline for Special Interest Meetings will be in early 2020: AMSI plans to decide on the exact dates in late November or early December. Applications are required at least three months in advance of the meeting.

If funding is also sought from AMSI, applications should be made via the AMSI website <http://research.amsi.org.au/workshop-funding/>. If funding is not being sought from AMSI, please use the application form available at <http://www.austms.org.au/Special+Interest+Meetings> and send it to the secretary, Deborah Jackson (email: Secretary@austms.org.au).

Applicants are reminded that there is a maximum grant of \$3,500 per meeting.

AustMS Accreditation

- Professor Andrew Bassom of the University of Tasmania has been accredited as a Fellow (FAustMS).
- Dr Peter Sokolowski, affiliated with RMIT University, has been accredited as a Fellow (FAustMS).

- Professor William Guo of Central Queensland Unoversity has been accredited as a Member (MAustMS).
- Peter Gallagher of John Paul College, Queensland, has been accredited as a Member (MAustMS).

Deborah Jackson AustMS Secretary
Email: Secretary@AustMS.org.au



Deborah Jackson (née Trueman) is a lecturer at La Trobe University. She began her academic career at Monash University and then moved to Swinburne University. After several years back at Monash, she joined La Trobe in 2010. Deborah was honorary Chair of the Victorian Algebra Group from 1996 to 2003 and its Secretary from 1994 to 1995. Deborah took over as Secretary of the Society in September 2019.

The Australian Mathematical Society

President:	Prof Jacqui Ramagge, FAustMS MAICD	School of Mathematics and Statistics The University of Sydney NSW 2006, Australia. jacqui.ramagge@sydney.edu.au
Secretary:	Dr P. Stacey	Department of Mathematics and Statistics La Trobe University Bundoora, VIC 3086, Australia. P.Stacey@latrobe.edu.au
Treasurer:	Dr A. Howe	Department of Mathematics Building #145, Science Road Australian National University Acton, ACT 2601, Australia. algy.howe@maths.anu.edu.au
Business Manager:	Ms May Truong	Department of Mathematics Building #145, Science Road Australian National University Acton, ACT 2601, Australia. office@austms.org.au

Membership and Correspondence

Applications for membership, notices of change of address or title or position, members' subscriptions, correspondence related to accounts, correspondence about the distribution of the Society's publications, and orders for back numbers, should be sent to the Treasurer. All other correspondence should be sent to the Secretary. Membership rates and other details can be found at the Society web site: www.austms.org.au.

Local Correspondents

ANU:	C. Cousins	Southern Cross Univ.:	G. Woolcott
Aust. Catholic Univ.:	B. Franzsen	Swinburne Univ. Techn.:	N. Sukhorukova
Bond Univ.:	N. de Mestre	Univ. Adelaide:	T. Mattner
Central Queensland Univ.:	W. Guo	Univ. Canberra:	J. Ascione
Charles Darwin Univ.:	K. Khan	Univ. Melbourne:	M. Robertson
Charles Sturt Univ.:	P. Charlton	Univ. Newcastle:	J. Turner
CSIRO:	R.S. Anderssen	Univ. New England:	B. Bleile
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Griffith Univ.:	B. Johnston	Univ. Sydney:	P. Kim
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Macquarie Univ.:	A. Sikora	Univ. Western Australia:	G. Wade
Monash Univ.:	A. Haley, G. Farr	Univ. Wollongong:	G. Wheeler.
Murdoch Univ.:	M. Lukas	UNSW Canberra:	T. Trudgian
Queensland Univ. Techn.:	P. Buenzli	Victoria Univ.:	A. Sofu
RMIT Univ.:	Y. Ding	Western Sydney Univ.:	J. East

Publications

The Journal of the Australian Mathematical Society

Editor: Professor Jon Berrick
Sydney Mathematical Research Institute (SMRI)
The University of Sydney, NSW 2006, Australia

The ANZIAM Journal

Editor: Professor Andrew Bassom
School of Mathematics and Physics
University of Tasmania, Australia

Editor: Professor Graeme Hocking
School of Chemical and Mathematical Sciences
Murdoch University, WA 6150, Australia

Bulletin of the Australian Mathematical Society

Editor: Professor John Loxton
Western Sydney University, Penrith, NSW 2751, Australia

The Bulletin of the Australian Mathematical Society aims at quick publication of original research in all branches of mathematics. Two volumes of three numbers are published annually.

The Australian Mathematical Society Lecture Series

Editor: Professor Jacqui Ramagge
School of Mathematics and Statistics
The University of Sydney, NSW 2006, Australia

The lecture series is a series of books, published by Cambridge University Press, containing both research monographs and textbooks suitable for graduate and undergraduate students.

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