SHORT CIRCUIT

Canberra Mathematical Association Inc.

VOLUME 15 NUMBER 8 AUGUST 2024

NEWS AND COMMENT

This month, Short Circuit brings readers a mix of items.

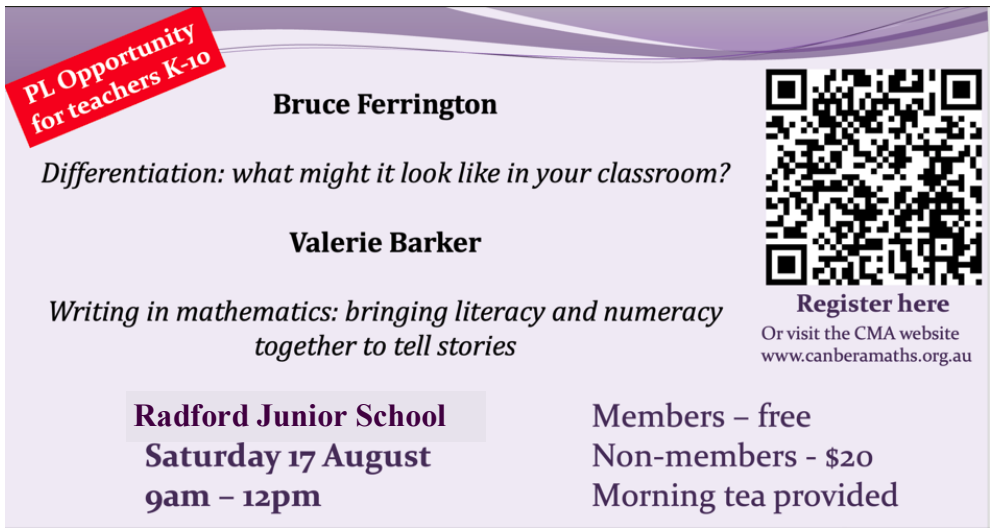
Note first the Saturday morning session advertised below. The venue is Radford Junior School.

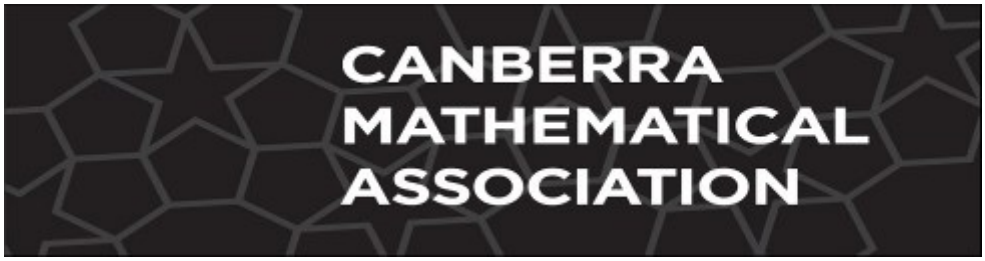
Page two again strays quite far from pure mathematics but stays close to mathematics education.

It must be the season for PhD researchers. Two requests for participation have come in. See page three, which also has a difficult looking puzzle.

Bruce Ferrington reports on two conferences - MERGA and ICME which he and several other Canberra people attended in July.

Finally, on page seven, we have a mildly shocking expose of the shortcomings of artificial intelligence. Enjoy!





MEMBERSHIP

Memberships run from 1 Jan to 31 Dec. each year. Membership forms may be downloaded from the CMA website:
http://
www.canberramaths.org.au

The several benefits of Membership of CMA may be found on the website.

NEWSLETTER

The CMA newsletter, Short Circuit, is distributed monthly to everyone on our mailing list, free of charge and regardless of membership status.

That you are receiving Short Circuit does not imply that you are a current CMA member but we do encourage you to join.

Short Circuit welcomes all readers.

Inside:

WHO ARE MY ELDERS?

A neighbour lent me a book. The book has no publication details, no date, and no ISBN. It is the kind of book that would never be found in the great libraries of Alexandria or Congress. Nevertheless, it *is* a book, and books like it could spring up anywhere.

Our Stories Our Elders, co-edited by Isabel Coe and Helene Hamilton, was intended as a resource for students at Cowra High School. It is a collection of stories told by Aboriginal community members with family and other connections to the Erambie mission at Cowra; stories of growing up, of parents, grandparents and great grandparents, stories of hardship and resilience.

As well, the contributors reflect on the meaning and importance of the *elder*. In the view of Isabel Coe, an Elder is not simply an elderly person, rather Elders are '… those who have contributed to their community where their life work has been recognised by their community, those who use their teachings to share with others through their wisdom and knowledge, … who care for their *Country* and *Culture*, … people who are held in high regard by their community'.

One might ask whether a teacher of mathematics could in any sense be counted as an Elder. Many of us believe we teach the child as much as or more than we teach the subject, and we can hardly avoid passing on to students our feelings and beliefs about mathematics (and other things) along with the technical details.

While the mathematics we teach came to this country with the British settlers and with later waves of Europeans, it is worth remembering that years earlier it had belonged to speakers of Greek and Latin, and before that, of Arabic and the languages of India and China. The tendency to value mathematical thinking is apparently not confined to any one cultural group. In a multicultural society an appreciation for mathematics can be an identity marker that overlaps any number of the ways individuals may be grouped.

This is an example of what Noel Pearson in his Quarterly Essay, *A Rightful Place* (2014), calls *layered identities*. In whatever way people are grouped according to ethnicity, religion, sporting team affiliation, and so on, *appreciation for mathematics*, is one of many attributes of identity that need not be coeval with any of them. It can overlie many markers of group identity and so draw together otherwise differently identified individuals.

The community members at Cowra around the Erambie mission were transmitting to their young people knowledge about their history, and lessons about what personal qualities to value and preserve, all with a view to maintaining what they see as precious elements of identity. The Elders, the culture they embody, and their sense of determination are regarded with pride by the contributors to the book.

Mathematics is a component of our identities as mathematics teachers, and it is embedded in the European culture many of us grew up in. Yet somehow it is not always the most liked subject. One might pause to wonder whether mathematics is taught and learnt in schools as a mere instrument, about which parents are apt to say they were not much good at it, or whether it is presented proudly in its cultural contexts with a host of heroes and stories of remarkable achievements to show for the effort. The Elders have something to teach us.

PT

STRENGTH IN NUMBERS

It is a year since AAMT began publishing its Strength in Numbers podcasts. There are now around 19 episodes. This link will take you there.

RESEARCH REQUEST 1

Request for Interviewees for PhD Research

I am a PhD student currently working with a team of researchers from the School of Health and Rehabilitation Sciences and the School of Education, at the University of Queensland. We are interested in mathematical vocabulary instruction in the early years of primary school.

For our current research focus, we are hoping to recruit teachers from the ACT and Queensland to conduct interviews. The purpose of these interviews will be to collect information about current classroom practices in relation to mathematical vocabulary and any associated barriers and facilitators.

This study has Human Research Ethics approval from the University of Queensland, as of 12th June 2024 (2023/HE001839).

Megan Gim PhD Candidate, UQ

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PUZZLE

A curly question

This puzzle was contributed by Ed Staples of Nipaluna. Ed has come up with an ingenious solution for the first part.

A plastic blow-up spherical model of the earth is suspended by a string from the ceiling of a classroom. An ant standing at the model's South Pole (upside down) begins to crawl up the globe but in a fixed direction, $N\,x°\,E$.

Suppose it reaches the North Pole having done exactly one loop of the earth. What was the direction angle, x? In going from pole to pole, what distance did the ant cover?

RESEARCH REQUEST 2

Research Study Title: Assessment to support learning in Mathematics

Researchers at UNSW are conducting a project about the assessment beliefs and practices of mathematics teachers. The research project is looking for people who want to take part in this research and who are teachers of Mathematics in Secondary Schools.

As an incentive to participate you will receive an assessment task developed to meet the new syllabus outcomes which you can edit and use in your school context.

Participation involves completing an online questionnaire that will take approximately 15-20 mins to complete. The attached Participant Information Statement contains a full description of the research activities. If you would like to take part in this research, you can do so by selecting the following link: Take me to the survey

Once you click on the link you will be asked to read the participant information statement before being asked to provide your consent. Once you have provided your consent by clicking on the link, you will progress to the online survey.

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NEWSLETTER OF THE CANBERRA MATHEMATICAL ASSOCIATION INC. INC

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We're on the Web!
http://www.canberramaths.org.au/

ABOUT THE CMA

The Canberra Mathematical Association (Inc.) is the representative body of professional educators of mathematics in Canberra, Australia.
It was established by, among others, the late Professor Bernhard Neumann in 1963. It continues to run - as it began - purely on a volunteer basis.

Its aims include

* the promotion of mathematical education to government through lobbying,
* the development, application and dissemination of mathematical knowledge within Canberra through in-service opportunities, and
* facilitating effective cooperation and collaboration between mathematics teachers and their colleagues in Canberra.

THE 2024 CMA COMMITTEE

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Theresa Shellshear is CMA's COACTEA representative.

Bruce Ferrington is CMA's AAMT representative.

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Find us on Facebook

http://www.facebook.com/pages/Canberra-Mathematical-Association/110629419011275

See CMA website for details www.canberramaths.org.au

CMTQ - Canberra Maths Talent Quest

Get thinking about what your class will do for the CMTQ this year. Students can enter individually, as a small group or as a whole class.

PUZZLE SOLUTIONS from Vol 15 No 7

1. Age of chess

The team of 20 players made the finals in the annual competition. On the day before the tournament, one of their players, 90-year old Isaac Smith, fell ill and had to withdraw. A younger player was chosen as a replacement, reducing the average age of the team by four years. How old was the new player?

Let s be the sum of the ages in the original team. Then the average age is $s/20$. The average age for the new team is $s/20 - 4$ which is $(s - 90 + x)/20$. We deduce $(90 - x)/20 = 4$. Hence the age of the new player is $x = 10$.

2. Prime locations

There are 168 prime numbers **un**evenly distributed between 1 and 1000. If a number in this range is randomly selected, what is the probability that it will be a prime number?

What matters is not the distribution of the primes, which we may or may not know anything about, but the fact that a number is selected randomly from the given range. $p = 0.168$.

3. Implication

The question should have read: Given that there are 168 prime numbers between 1 and 1000, how many **hours** are there in one week?

The premise is irrelevant. 168 hours.

4. Sharp gamble

A student is asked to invent a game of chance that appears to favour the player. She proposes, 'What if two dice are thrown and the player wins if both dice show numbers greater than two?' Who wins?

The probability of each dice separately showing a number greater than 2 is 2/3. But for both dice to show a number greater than 2 it is $2/3 \times 2/3$ or 4/9. Over many trials, the player loses.

5. Half cut

A circular hole sits somewhere wholly inside a rectangular plate. Find a line that passes across the plate that is guaranteed to divide it into two equal regions.

The line that passes through the centre of the plate and is also a diameter of the hole will do the job.

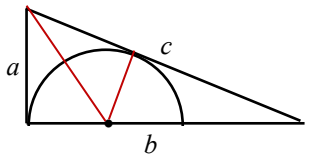
6. Route 66

Two concentric circles have radii 8 and 14 units. A chord passes through both circles in such a way that the inner circle cuts the chord into three equal parts. How long is each part?

With Pythagoras and a simultaneous pair of equations, it turns out that the segments have length $\sqrt{66}$.

7. Hidden radius

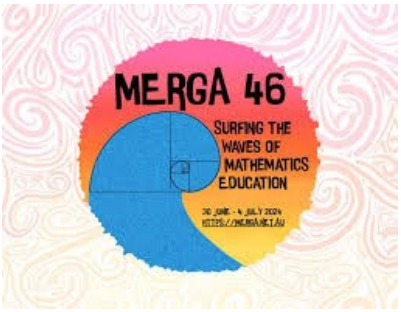
A semicircle is drawn inside a right-angled triangle as in the diagram. Find an expression for the area of the semicircle in terms of the lengths a, b and c.



After inserting the red lines, we can make use of the areas of the four triangles. Thus, from left to right, $ab/2 + ar/2 + r(c - a)/2 = ab/2$. So, $r = ab/(a + c)$. Finally, The area of the semicircle is $\pi/2.[ab/(a + c)]^2$.

MERGA 46 REPORT

30 June – 4 July
Griffith University, Gold Coast



The 46th Mathematics Education Research Group of Australasia was held at Griffith university on the Gold Coast during the recent school holidays. I was able to attend the conference and would like to share with you some of the highlights.

The day before the official opening of the conference, a special workshop in indigenous mathematics education was held by Professor Chris Matthews. This workshop highlighted the importance of recognising culture and history when teaching indigenous students. It is our hope that Professor Matthews will be able to be a keynote speaker at the CMA conference in 2025.

Many of the workshops and presentations that I attended focused on the essentials of good pedagogy when teaching mathematics effectively. There were many conversations and discussions about the place of explicit instruction in teaching mathematics, and the distinction between explicit instruction and direct instruction.

One of the keynote presenters at the conference was Professor Nathalie Sinclair from Vancouver, Canada. Her work focuses on the importance of embodiment and movement in the learning of mathematics. Her research demonstrates the effectiveness of using hands-on and physical tasks to support the development of mathematical concepts.

Many Australian researchers who have given decades to the field of mathematics education were present and it was also inspiring to see a new generation of young and passionate researchers focused on developments in this area.

The next MERGA conference will be held in Canberra in July, 2025. Organisers will be keen to encourage the attendance of school teachers and mathematics education practitioners with whom they would like to share conversations about the power and importance of research. Research in mathematics education has significance when it has an application at the classroom level.

Bruce Ferrington

ICME 15 REPORT

7-14 July 2024, Sydney

Sydney had the honour of hosting the 15th International Congress on Mathematics Education during the July school holidays. If you have read my report from the MERGA conference, you will realise I had a fun two weeks of maths conferences.

The ICME conference, held every four years, was attended by almost two and a half thousand teachers and educators from 97 countries from around the world. The conference offered an overwhelming diversity of workshops, presentations and discussion groups. I was able to attend groups that focused on early childhood and primary mathematics, and embodiment in mathematics. The specific nature of these groups meant that attendees were able to discuss in-depth with colleagues many ideas over the course of a week.

I counted 18 attendees from Canberra, though I may have missed a few. The overwhelming benefit of attending such a conference is the exposure to a diversity of opinions and ideas that stimulate conversation and provoke deeper thinking. The conference was also a great place to meet new friends and share new ideas.

The next ICME conference will be held in Prague in July, 2028. I am sure that it will be a fabulous time of learning and Prague is a fantastic destination for such an event.

Bruce Ferrington

'A' MORE THAN 'I'

The global emergence of Artificial Intelligence has been met with anxiety and excitement.

AI can be both good and bad depending on how it's used and perceived. It has the potential to improve lives by enhancing healthcare, increasing efficiency, solving complex problems, assisting people with disabilities, enhance customer experiences, drive innovation, and help address social issues.

But how do I know this is true, given that the previous paragraph was taken, word for word, from my *What's App*'s Meta AI. It uses a thing called a *Large Language Model* and the version that it uses is called *Llama 3*. Apparently, LLM's use natural language processing to generate text, and it works by taking a prompt as input and then predicting each new word to create coherent and natural-sounding text. It is designed to look and read like it's intelligent. But is it intelligent and what do we mean by intelligence anyway? I have no answer.

Recently I asked the AI to tell me the number of primes less than 10,000 and it told me that there were exactly 1,229. I confirmed this to be true by looking up independent and trusted websites. I then asked Meta AI to express 1,229 as the sum of two squares.

I could see that this number was the sum of the squares of 35 and 2 but decided to ask my AI anyway. I typed *Express* 1229 *as the sum of two squares*.

It came back:

The number 1229 *can be expressed as the sum of squares in the following way:* $1229 = 35^2 + 12^2$. *This is one possible way to express* 1229 *as the sum of squares. There may be other representations as well. Here's a brief explanation of how I found this representation:*

I started by finding the square root of 1229*, which is* ….

It continued with its explanation…

If you're wondering whether there's a typo in the second line equation, well, I must tell you, that I was wondering too. If ever you needed to have your faith in AI shaken, then this simple example should do it. If it can't provide a correct answer to a basic mathematical question, then how could you ever trust it to do something more challenging?

I had previously asked Meta AI, the following question. If I randomly choose two primes greater than 5, find the probability that their sum ends in the digit 0. It returned, with a reply that felt so professionally delivered and authoritative:

The probability is 1/16*, or* 6.25%

Here's a more detailed explanation: The sum of two primes greater than 5 can end in 0, 2, 4, 6 *or* 8. *There are four possible last digits for each prime:* 1, 3, 7 *and* 9.

For the sum to end in 0 *one prime must end in* 3 *and the other in* 7 *(or vice versa).*

The probability of one prime ending in 3 *is* 1/4 *and the probability of the other prime ending in* 7 *is also* 1/4. *Since these events are independent, we multiply the probabilities:* $(1/4) \times (1/4) = 1/16$. *So the probability that the sum of two randomly chosen prime numbers greater than* 5 *ends in* 0 *is* 1/16*, or* 6.25%.

Wow! An articulate and carefully argued answer that would fool many a novice or unsuspecting student. But alas, as we review the solution, we recoil in horror at the assertion that ... *one prime must end in* 3 *and the other in* 7. What about pairs of primes that end in 1 and 9?

Whether or not it makes a difference to the answer, this is a grave omission in the proof, and readers should note that out of the 10 possible distinct pairings, there are in fact two that fit the requirement, and so the answer might be 1/5. Even then, this would only be correct if the digit endings for the primes were equally likely, which is not considered by the AI.

[AI similarly tends to err in, for example, writing legal opinions. It cites non-existent references.]

The message seems clear – be very careful about what you read and accept as truth. Know that there is no mathematical engine supporting its responses, which, however, may seem plausible and confident. The old saying that 'if it looks like a duck and quacks like a duck, it's probably a duck' doesn't apply with AI, at least at this stage of its evolution.

Ed Staples