SHORT CIRCUIT

Business Name

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NEWS AND COMMENT

The Annual General Meeting of the Canberra Mathematical Association was held on 13 November. The meeting appointed a new committee for 2026, whose members can be seen on page 5.

Two new members were welcomed to the committee: Katrina Simms and Linda Goth, while, after many years of highly valued service, Jo McKenzie has stepped down.

During the evening, awards were made congratulating four outstanding pre-service teacher graduates from the University of Canberra and the Australian Catholic University.

They are: Ellouise Rabets (Early childhood, ACU), Sienna Pitt (Primary & secondary, ACU), Mitch Calley (Secondary, UC) and Ashleigh Hobbs (Primary UC)

We wish them well for their teaching careers and welcome them as CMA members.

In this edition we have an article (on page 2) from Peter Fox of Texas Instruments, stimulated by Bruce Ferrington's article from the previous edition. And, the piece on page 6 is a reflection on articles by some indigenous educators that were published in the Australian Education Union magazine for Winter 2025.

CANBERRA MATHEMATICAL ASSOCIATION

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.

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

Inside:

BOB DOESN'T KNOW

From Peter Fox

Following Bruce Ferrington's delightful deliberations in the previous issue of Short Circuit (*The Wrong Question*); it seems appropriate to pose the following:

A chord is drawn inside a circle. What is its expected length?

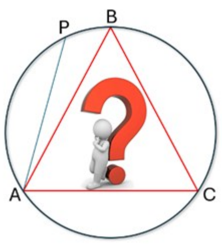
Given a unit circle, every chord has its length in the range 0 to 2. Using some year 12 calculus, it is possible to deduce the average or expected value of the chord length.

[The accepted solution is $4/\pi$, and this can be confirmed by computer simulation or by a rigorous measure-theoretic argument.]

However, if we ask the following slightly different question, something unsettling happens.

A circle is drawn and a random chord is drawn inside. What is the likelihood the chord is longer than the side of an equilateral triangle inscribed in the circle?

A diagram for this problem is shown below. The equilateral triangle ABC is inscribed in the circle. A chord AP has been drawn.



Problem: Can we simply assign one end of the chord to be on vertex A?

To answer this vertex problem, imagine drawing the chord then rotating the equilateral triangle around the circle until another vertex lands on point A. Does this produce any loss of generality? Now imagine point P is moved around the circle.

Question: Through what range of angles will the chord AP be longer than the side length of the equilateral triangle?

Any point on the arc (BC) will produce a chord longer than the side length of the equilateral triangle. If every point on the circumference of the circle is equally likely, we arrive at the answer: 1/3, that is the proportion of randomly generated chords that will be longer than the side length of the equilateral triangle! Job done! Or is it?

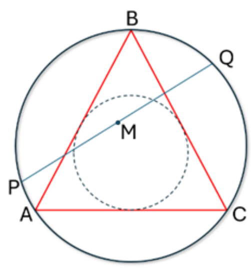
Should randomly generated chord lengths produce a uniform distribution? Are we more or less likely to get chords close to the diameter of the circle or more shorter chords? Here's where we run into a problem, humans are not very good at 'random', we are less likely to draw really short chords. I have done this experiment at numerous workshops and collected data for 10,000+ of chords! A program produces the same 1/3 answer but reveals some uncomfortable data around chord lengths!

An alternative approach

Suppose you place a point randomly somewhere inside the original circle. The point represents the midpoint of a unique chord.

Take some time to ponder how the midpoint relates to:

- The chord
- The centre of the circle
- The side lengths of the inscribed equilateral triangle.



A little experimentation will reveal that if the midpoint of the chord lies within the incircle of the equilateral triangle, the chord will be longer than the side lengths of the equilateral triangle. Now we have a real problem. The incircle is ¼ of the area of the original circle, this means only ¼ of our randomly generated chords will have a side length longer than that of the inscribed equilateral triangle, a complete contradiction to the previous result!

Don't bother looking for the answer in the **B**ack **O**f the **B**ook (BOB). Don't bother trying to pick the geometry apart. Both answers can be defended [and confirmed by computer simulations].

As Bruce asked: why are we so 'dogmatic as to demand a single universal solution in mathematics?' If this chord problem is niggling at your determination to find a single answer, there is **yet another approach** that leads to yet another solution. The problem is known as Betrand's Paradox. The issue relates to: 'How do we define a randomly generated chord?'

[A more complete discussion of Bertram's paradox, including the further solution mentioned in this text, can be found in the Numberphile series on YouTube, by clicking on this link.]

Betrand's paradox is not the only construction that draws mathematicians to a perplexing conclusion. The Keynesian Beauty Contest is equally challenging but for different reasons. [See this YouTube video.]

The Nobel prize winning mathematician: John Nash provided an insight into the Keynesian Beauty contest. The Nash Equilibrium is not an answer to the Keynesian Beauty contest, but just a region where you might expect to find the result.

The Keynesian Beauty contest is much more than a 'thought' problem and is definitely not trivial. The movie: Dumb Money, [available on Netflix] goes some way towards demonstrating how the social sciences, in particular, social media, create perplexing problems for mathematics.

Still looking for evidence on why we should integrate more of the problems Bruce was alluding to? Check out the Matching Pennies problem. The theoretical result is obvious, the practical result however is strongly linked to game theory, and the dilemma resulted in the unnecessary expenditure of 100's of trillions of dollars. And your students dare to ask, 'Where are we ever going to use mathematics in the real world?' Perhaps, as Bruce says, 'We are asking the wrong questions'.

MATHS 300

From the Australian Association of Mathematics Teachers website:

Maths300 is a library of inquiry-based maths lessons that is owned and maintained by AAMT. The lessons are available to teachers in Australia and internationally through a subscription.

There are about 200 different lessons in the library, from Years 1-12 and covering all the content strands of the Australian Curriculum: Mathematics.

The underlying principle of each lesson is to encourage students to learn through inquiry, to collaborate and think like mathematicians.

Teachers and students find the Maths 300 activities and investigations to be a positive and engaging way of exploring and understanding mathematical concepts in the classroom.

CMTQ RESULTS

Canberra Mathematics Talent Quest 2025

The CMTQ entries fall into year levels and, within year levels, into the categories Small Group, Individual and Class.

Listed are the names of the students, the school they attend, the title of their submission, and the ranking - 1st or 2nd - in their category.

Continued next page

Year 4

(Small Group) Aarya, Hamish, James
Canberra Grammar
Deciduous Trees and Leaves 1st

(Small Group) Athena, Jessie
Canberra Grammar
Angles in Ballet and Gymnastics 2nd

Year 5

(Small Group)
Nathan Mellor, Kavya Bhutoria, Sakkhota Dey
Mother Teresa School
Calculating World Tour 1st

(Small Group) Milo, Jack, Jia-Ning
What is the most efficient way to travel 5km?
Canberra Grammar 2nd

(Individual) Aarya
Canberra Grammar
The Math in Cooking 1st

Year 6

(Small Group) Dianne, Esther
Canberra Grammar
Possibilities of Guessing a Password 1st

(Individual) Risha
Canberra Grammar
Equilibriums 1st

Year 8

(Small Group) Tabitha Peters, Evelyn Mcintosh, Abigail Craven, Sarah Waissi, Preyam Kadiketla
Melrose HS
How many helium balloons does it take to lift a Tesla?
1st

(Small Group) Ethan Tobin-Ledez, Jamie Konrad, Zachary Warnes
Melrose HS
How fast does your racquet have to be moving during a serve to break a tennis racquet string using different balls?
2nd

(Individual) Mason Li
Melrose HS
How much force is required for you to kick a soccer ball across a soccer field? 1st

(Individual) Emaad Aahil
Melrose HS
How much sound pressure it will take to lift the average person? 2nd

Year 9

(Small Group)
Gelarin Asali Starki, Diyar Balchandar, Emaan Khan, Kosha Nayak, Prakiti Baral
Melrose HS
Which sport is the best sport? 1st

(Small Group)
Imogen Hubbard, Ema Colac
Melrose HS
Probability 2nd

(Individual) Ewan Piddington
Melrose HS
What is the average rate of acceleration when doing floor and vault in gymnastics? 1st

(Individual) Haiyang Sun
Melrose HS
A Dance of Math and Games 2nd

(Class) AAMP Excursion Class
Melba Copland
Year 9 AAMP Excursion Class 1st

Year 10

(Small Group) Adina Khan, Zoe Delaney
Melrose HS
Physics in Motion: Crossing a 100. Metre gap with the right speed, gravity and air resistance 1st

(Small Group)
Reece Howe, Nadia Rafaella Torres
Melrose HS
How strong are Spiderman's webs and what is a real life equivalent? 2nd

(Individual) Kavin Vijayakumer
Melrose HS
How high could you theoretically jump? 1st

(Individual) Timothy Dowling
Melrose HS
Riemann Zeta function 2nd

ABOUT THE CMA

NEWSLETTER OF THE BUSINESS NAME INC

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

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 2026 CMA COMMITTEE

President	Aruna Williams	Erindale College
Vice President(s)	Bruce Ferrington,	Radford College
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	Andrew Wardrop	
	Yuka Saponaro	Melba Copland Secondary School
	Bernadette Matthew	Mother Teresa School
	Linda Goth	
	Katrina Simms	

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

CONFERENCE 2026

Save the date: the 2026 CMA Annual Conference will be held at ADFA on Saturday 28th March. The theme is *Mathematics: Are You Game?*

If you have contributions of ideas, experiences or research to share at the conference, contact Valerie Barker via canberramaths@gmail.com.

ON COUNTRY

The winter 2025 edition of the Australian Education Union's magazine *Australian Educator* celebrates Aboriginal and Torres Strait Islander ideas on education in a collection of thought-provoking articles. Several of these stand out given CMA's commitment to aboriginal student outcomes in mathematics education.

(The magazine is distributed to union members in hard-copy but anyone can read it online by clicking the link above.)

Making good on a well-intentioned commitment may not be as straight-forward as one might wish. Scott Gorringe, in *Changing the narrative*, points out the hazard of deficit language. When, for example, we compare 'education' with 'Aboriginal education' the implication is that aboriginality is a problem.

Gorringe characterises this effect of language as coming from a colonial worldview and he identifies two dominant approaches to fixing the aboriginal 'problem'. One he calls 'doing to' (the dictator) and the other 'doing for' (the saviour). Neither is effective, he suggests, and should be replaced by 'doing with'.

The deficit discourse, which includes the phrase 'closing the gap', needs to be challenged. 'An education is needed', says Gorringe, that 'encourages inquisitiveness, reflectiveness, robustness, courage, positivity and the validation of one's contribution from [one's] own worldview'. Understanding the discourse is critical for such educational success.

But understanding the discourse does not of itself make it clear what form such an education might take. A clue to this is offered by Mike Butler in *Country as teacher*.

Butler draws on a research paper reporting work done by Ben Wilson, David Spillman and others through the University of Canberra. The paper, *Re-invigorating Country as teacher in Australian schooling: …*, can be freely accessed.

Twenty-six young educators participated in a trial of being periodically 'on Country', and then reflecting on their learnings arising from the experience. (Lest readers imagine a kind of irrational mysticism here, a careful reading of the original paper is highly recommended.)

Butler writes:

> 'In the Aboriginal worldview and Torres Strait Islander worldview, Country is a big term referring to the land, sea and sky, and the interconnected relationships between people, animals, plants and the environment. The way Australia's oldest cultures handed down cultural, historical and STEM knowledge was with a sense of country so big, it deserved the capital C.'

Clearly, learning from Country in this broad sense has been a successful survival strategy for aboriginal people for thousands of years. The idea involves an openness to and a caring for the full matrix in which a person exists. In this view, knowledge is constructed by listening to Country, by becoming aware of things as they are. This is a pedagogy of place, including place in its non-spatial sense.

By contrast, a straw man of sorts is posited in the discussion, appearing as 'Eurocentric epistemic power, with its focus on rationalism, atomisation and anthropocentrism', and this not without some justification.

The model of the teacher as expert is certainly familiar. We also have the state as expert. A curriculum is set for the whole nation overriding local interests, intolerant of variation or dissent, and with limited room for local creativity. Thus the state, for all sorts of plausibly good reasons, transmits an ideology potentially to the detriment of students learning about what actually is.

The alternative to this straw man is a pedagogy through which learners respond to their exact circumstances, their Country, with openness, observation, experiment and imagination, disregarding convention and dogma if necessary.

The Butler article quotes Ben Wilson's contention that connection with Country is an inescapable condition of our lives but being *related* to Country, being *on* Country, is something else.

Those of us who lack an Aboriginal heritage may wonder how being on Country applies specifically to mathematics education and, in any case, whether a whitefella teacher has any authority to implement such a pedagogy.

On the second point, consider that when we acknowledge being on the country of the groups that occupied our particular location (the Ngunnawal and Ngambri peoples in the ACT), we should also acknowledge that the idea of being 'on Country' is an excellent metaphor for a state of mind that has been recognised in many cultures as a prerequisite for learning. By correctly attributing the metaphor we can permit ourselves to enter that place and use its terminology.

We may claim that it was through being 'on Country' that Nicholas Copernicus, a man from eastern Europe, a man looking at and caring about the sky, came to see that a picture of the sun with the earth and the planets going around it made more sense and was less complicated than the prevailing earth-centric view.

Perhaps Isaac Newton, an Englishman, who was visiting the country to escape the plague, was 'on Country' when he came to see that whatever made an apple fall would also make the moon fall into its orbit and that a new kind of mathematical thinking would describe such things precisely.

It could be said that George Washington Carver, an African American born to slavery in the plantations of the confederate south, was truly 'on Country' when he saw that growing peanuts would restore the vitality of soil depleted after a cotton crop. Some say the peanuts spoke to Carver and he listened.

On the question of how an Aboriginal perspective relates to mathematics education, the article by Margaret Paton, *Knowledge that adds up in maths education*, cites some first-nations educators who have addressed the issue.

Professor Chris Matthews, CEO of the Aboriginal and Torres Strait Islander Mathematics Alliance (ATSIMA), who instigated the summit in April 2024 that led to CMA's engagement, points out that mathematics like all knowledge reflects the people who made it. It is not culture-free. He has advocated a way of teaching that moves from an observation in the real experience of the student, through abstraction, to mathematics and a critical reflection. He calls this scheme the Goompi model.

Dr Amber Hughes, a researcher at the University of Newcastle speaks of 'decolonising maths', as does Professor Kevin Lowe at the University of New South Wales. All three would agree that mathematics learning assumes and requires cultural connections.

This is consistent with the 'on Country' concept, provided *country* is understood widely enough, as it is in Mike Butler's explanation.

In this view, the teacher must enter the student's Country in order to catalyse a learning experience.

PT