Short Circuit

Newsletter of the Canberra Mathematical Association INC

VOLUME 13 NUMBER 7 JULY 2022

NEWS AND COMMENT

Any sharp-eyed observer looking through a school window just now is likely to see not one but two grey elephantine presences lurking.

The first is the disruption due to the pandemic—including the too frequent impossibility of running proper classes due to missing staff, and the frightening level of catch-up that many students now need after their experiences of remote learning. In the case of mathematics, these factors add to the difficulties due to the already short supply of qualified teachers.

The second elephant, behaving as though unaware of the first, is the latest version of the Australian Curriculum and the ACT Education Directorate's insistence on an unrealistic and otherwise flawed time-line for its implementation. Teachers have scarcely enough time to teach, these days, let alone time to design new courses and assessment tools. Moreover, a sudden rather than a staggered implementation will mean some topics will be missed or repeated at some levels in some subjects. The Directorate may choose to insist on its plan, but the project is bound to fail without some serious compromises.

CMA would like to assure the Directorate that as far as this small volunteer organisation is able, it will continue to support mathematics teachers in their professional roles. To this end, CMA can provide a platform, principally through the CMA conference, through which the Directorate is warmly invited to deliver the professional learning sessions it feels are necessary for the Australian Curriculum implementation.

In this vein, Rachel Whitney-Smith (ACARA) will be a presenter at the CMA Conference, Saturday 13th August. Register now!!

As usual, Short Circuit welcomes readers' comments and contributions.

CANBERRA MATHEMATICAL ASSOCIATION

Inside:

Coming Events:

2022 CMA conference ADFA August 13.

Wednesday Workshops:

Check for notices sent separately.

MEMBERSHIP

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

Membership of CMA includes affiliation with the Australian Association of Mathematics Teachers and a subscription to one of two AAMT journals.

As a member, you are entitled to attractive rates for the CMA annual conference and CMA professional development events.

CMA members may attend conferences of the AAMT affiliates in other states, MAV, MANSW, etc. at member rates.

PUZZLES

1. Strange but true

Someone found these equivalences:

$\sqrt{(2\ 2/3)} = 2\sqrt{(2/3)}$
$\sqrt{(3\ 3/8)} = 3\sqrt{(3/8)}$
$\sqrt{(4\ 4/15)} = 4\sqrt{(4/15)}$
$\sqrt{(5\ 5/24)} = 5\sqrt{(5/24)}$
$\sqrt{(6\ 6/35)} = 6\sqrt{(6/35)}$

Is there a pattern? If so, how far does it continue?

2. Devilish exponentials

There may be easy solutions to these difficult equations. But, in each case, having found one can you be sure there are no others?

(a) $(8^x - 2^x)/(6^x - 3^x) = 2$.
(b) $(4 + \sqrt{15})^x + (4 - \sqrt{15})^x = 62$
$3^x - 54x + 135 = 0$

3. Target practice

Players *A* and *B* take turns shooting at a bullseye. Player *A* goes first. The first player to hit the bullseye wins. Player *A* hits the bullseye with probability *a*, and *B* with probability *b*. What is P(*A*), the probability that *A* hits the bullseye first?

HOLIDAYS

We are somewhat reliably informed that an astronomer, a physicist and a mathematician were holidaying in Scotland, or possibly in Tasmania.

Glancing from a bus window they saw a black sheep grazing in a field or maybe in a paddock.

'How interesting', observed the astronomer, 'all Tasmanian sheep are black!' To which the physicist responded, 'No, no! *Some* Tasmanian sheep are black!' The mathematician gazed heavenward in supplication, and then declared, 'In Tasmania there exists at least one paddock, containing at least one sheep, *at least one side of which is black*.'

CONFERENCE

The CMA 2022 conference is only weeks away.

Registration is open for the conference through the CMA website. We hope to see you there.

Offers of **workshop presentations** are invited. Email the conference organising committee very soon if you have a workshop proposal.

The **medals** that CMA provides for colleges will be available for collection at the conference. It will be a big help if teachers can collect these on the day.

CMTQ

The Canberra Mathematics Talent Quest is the entrance point in the ACT for the National Mathematics Talent Quest. See the CMA web page for details.

The CMA committee recognises the difficulties many schools face, mainly due to staff shortages, in considering extra activities such as the CMTQ. Nevertheless, we hope the talent quest will be of benefit to those who are able to take it on.

NMSS

The National Mathematics Summer School (NMSS) is a program for motivated and high-achieving school students that has been held each January since 1969.

The 55th NMSS is planned to be held in Canberra from 8 to 21 January 2023. The program is designed for students who are progressing to Year 12 in 2023.

Application details will be available soon on the CMA website.

Change – one of life's constants?

Canberra Mathematical Association Annual Conference 2022

Australian Defence Force Academy

Saturday 13th August 2022 9am-5pm

Six sessions of talks/workshops for all levels Early Childhood - Yr 12

All food + President's drinks

Great prizes Trade stalls

***Registration*: $100 member**

$50 concession $150 non-member

Keynote speakers:

Prof Emma Sparks (Rector at UNSW Canberra)

Prof Jason Sharples (Bushfire Group UNSW Canberra)

(Neville de Mestre Memorial Lecture)

Details and registration at:

canberramaths.org.au

Contact: *p.mcintyre@adfa.edu.au*

NEWSLETTER OF THE CANBERRA MATHEMATICAL ASSOCIATION INC

PO Box 3572
Weston ACT 2611
Australia

E-mail: canberramaths@gmail.com

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 2022 CMA COMMITTEE

President	Aruna Williams	Erindale College
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	Andrew Wardrop	
	Sue Wilson	
	Yuka Saponaro	Amaroo School
	Jo McKenzie	ACT Education Directorate
	Joe Williams	

Theresa Shellshear is CMA's COACTEA representative.

Sue Wilson is CMA's AAMT representative.

Joe Wilson is the website manager.

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Find us on Facebook

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

BOOKS

The June AAMT meeting was held in Brisbane at the QAMT Conference. The keynote speaker was **Simon Singh** (via Zoom). He spoke about his books. For example:

The Code Book ...offers the first sweeping history of encryption, tracing its evolution and revealing the dramatic effects codes have had on wars, nations, and individual lives. From Mary, Queen of Scots, trapped by her own code, to the Navajo Code Talkers who helped the Allies win World War II, to the incredible (and incredibly simple) logistical breakthrough that made internet commerce secure.

Throughout the text are clear technical and mathematical explanations. It will make you wonder how private that e-mail you just sent really is.

The Simpsons and their Mathematical Secrets

You may have watched hundreds of episodes of *The Simpsons* (and its sister show *Futurama*) without ever realizing that embedded in many plots are subtle references to mathematics, ranging from well-known equations to cutting-edge theorems and conjectures. That they exist, Simon Singh reveals, underscores the brilliance of the shows' writers, many of whom have degrees in mathematics in addition to their unparalleled sense of humour.

While recounting memorable episodes such as *Bart the Genius* and *Homer3*, Singh weaves in stories that explore many things mathematical. Along the way, Singh meets members of *The Simpsons'* brilliant writing team-among them David X. Cohen, Al Jean, Jeff Westbrook, and Mike Reiss-whose love of arcane mathematics becomes clear as they reveal the stories behind the episodes. With wit and clarity, displaying a true fan's zeal, and replete with images from the shows, photographs of the writers, and diagrams and proofs, *The Simpsons and Their Mathematical Secrets* offers an entirely new insight into the most successful show in television history.

PARALLEL

At the QAMT conference, Simon Singh also introduced his *Parallel* website (parallel.org.uk), a resource for extending interested maths students.

It has weekly maths challenges for students. Teachers can have a teacher account which gives them a code. The student can put in the code and teachers can see the questions they have been doing. This is designed to be self-contained and done at home, for particular students rather than as a whole class activity. Previous questions are archived, and available.

GROWING MATHEMATICALLY—AAMT

This initiative is explained at the mathseducation site.

The current project applies Growing Mathematics to multiplicative thinking skills. It supports a targeted approach to multiplicative thinking in the middle years based on an evidence-based learning progression.

More online resources have recently been added to this project. Online resources include a teachers' manual, teaching tasks and assessments, student work samples and case studies. There are 8 teaching task booklets, corresponding to the zones of the assessment framework. The booklets include some rich tasks from reSolve and Maths 300 that can be used with multi-zone groups plus specific tasks for students who are working in that zone.

SURROUNDED—A GAME

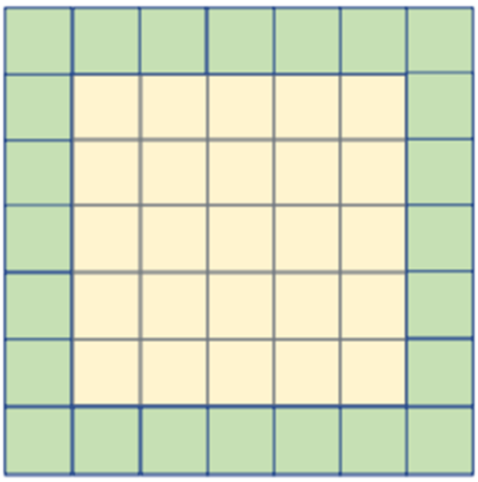
The game *surrounded* described in this article was invented recently by Ed Staples as something that might be investigated in the classroom.

Ed showed the description of the game to his mathematical contacts, specifically asking them whether they thought the game was *fair* in the probabilistic sense. Quite a bit of debate ensued and some time elapsed before a safe verdict emerged.

Two main ideas were explored in the discussion, at first seeming to lead to contradictory conclusions. Readers of Short Circuit are invited to exercise their powers of analysis and to come up with their own reasoned opinions. Ed will provide some analysis in the next issue together with a simpler example.

Whichever way one looks at it, Ed's game clearly has the potential to stimulate mathematical thought.

The game of *Surrounded* is played on a 7 by 7 electronic grid as shown below.



A screen in front of the player shows the rolling of what looks like a regular die, with numbers from 1 to 6, but the die is loaded in such a way that the probability of any number n being rolled is k/n for some constant k. So, for example, the probability of rolling a 3 is $k/3$ and the probability of rolling a 5 is $k/5$, etc.

[An initial classroom task might be to determine what the number k has to be.]

Each time the player presses a button, a dollar is deducted from the player's balance (the machine requires a minimum balance of $50 to start), and the depicted die tumbles around and lands with a number uppermost. We assume complete independence on each 'throw'.

If that number is a 1 or a 5, a green perimeter square lights up. That's good news for the player. Otherwise, a yellow central square lights up and that's good news for the bank!

The game finishes when either all perimeter squares are lit up (a win to the player and the return is double the player's stake), or else all central squares are lit up (a win to the bank and a loss of all staked money for the player).

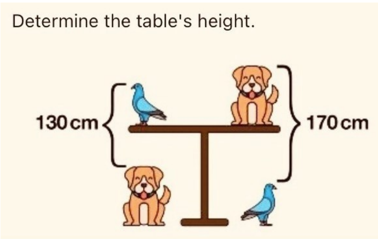
CAMBRIDGE EDUCATION

At the recent Queensland Maths Teachers' Conference, our representative, Sue Wilson, saw a new Cambridge Education professional learning resource, *Primary Teacher's Maths Journeybook - a Year of Professional Learning*, by Lucy Rycroft-Smith.

Based on the popular *Espressos* from Cambridge Mathematics, which provide clear and accessible summaries of recent mathematics education research, this reflective *journeybook* contains everything a primary/early years teacher needs for a year's worth of evidence-informed professional learning in mathematics education. Whether working collaboratively in teams, with a mentor, or individually, teachers write directly in the book, which then serves as a detailed record of their learning that can be returned to time and again. The book includes 20 specially-adapted *Espressos*, along with prompt questions, guided reflections, and stimulus material to support understanding and using research in the mathematics classroom.

PUZZLE SOLUTIONS from Vol 13 No 6

1. Dogs and pigeons



Let d, t and p be the heights of the dog, the table and the pigeon respectively. Then, $t = 130 + d - p$, and $t = 170 + p - d$. Adding these equations, we have $2t = 300$. So, the table height is 150 cm.

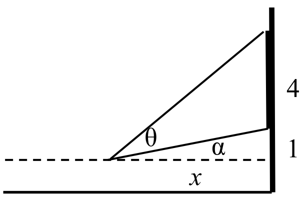
2. People and chairs

Two-thirds of the people in a room are seated in three-fourths of the chairs. The rest of the people are standing. If there are 8 empty chairs, how many people are in the room?

Translating into algebra, we can write $2/3\ p = 3/4\ c$ where p and c are the numbers of people and chairs in the room respectively. Also, $1/4\ c = 8$. This means there are 32 chairs. Hence, $2/3\ p = 24$ and so, there are 36 people. Four people would remain standing even if all the empty chairs were occupied.

3. Maximum angle

A picture 4 metres high is mounted on a vertical wall so that its lower edge is 1 metre above eye level. How far from the wall should the viewer stand to maximise the viewing angle, and what is the maximum viewing angle?



Since this problem was given to a year 9 class, we looked for a non-calculus solution. Note that as the viewer's position moves from far away to nearer the picture, the angle θ first increases and then decreases. We want to maximise

$\theta = \arctan(5/x) - \arctan(1/x)$ or equivalently, maximise $\tan\theta = (5/x - 1/x)/(1+5/x^2)$.

Observe that $\tan\theta$ can be considered as a function of x described implicitly by the rearranged equation $x^2 \tan\theta - x + 5\tan\theta = 0$. In general there are two values of x that give the same value for $\tan\theta$. The roots, $x = (1 \pm \sqrt{(1 - 20\tan^2\theta)})/2\tan\theta$ must be symmetrically spaced about the maximum value of the function for $\tan\theta$, which occurs when the roots coincide. That is, when the term under the square root sign is 0. So, $\tan\theta = 1/2\sqrt{5}$. From this we deduce that $x = \sqrt{5}$.

The maximum viewing angle is about 42°.

4. Working words

A and B working together can complete a job in 24 days. If A completes half of the work alone and thereafter, B completes the remaining work, the work will be completed in 64 days. What would be the difference between the time taken by A and B if each completes the whole job separately?

In terms of bricklaying, A lays x bricks per day and B lays y bricks per day. After 24 days they must have laid $24(x + y)$ bricks. Half the job is $12(x + y)$.

Hence, we know that $12(x + y)/x$ days + $12(x + y)/y$ days adds to 64. This leads to the quadratic $3x^2 - 10xy + 3y^2 = 0$

Thus, $x = 3y$. That is, A works 3 times as fast as B. Thus, the total bricks laid is $96y$ or $32x$. A would take 32 days to complete the entire job while B would take 96 days. The difference is 64 days.

FREE STUFF

EduTECH 10-11 August, Melbourne Convention and Exhibition Centre—AAMT has been given a limited number of free tickets. CMA members who are interested in attending should contact CMA (attention: Sue Wilson) promptly. Travel and accommodation are the member's own responsibility.

EduTECH is a 2-day conference with over 300 speakers and 10,000 attendees. The exhibition hall showcases hundreds of international exhibitors and promises “the latest developments and new digital technologies, products and solutions available to help Australian educators improve teaching and learning.”

https://www.terrapinn.com/exhibition/edutech-australia/index.stm