SHORT CIRCUIT

Newsletter of the Canberra Mathematical Association INC

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NEWS AND COMMENT

Deck the halls! 'Tis the season for marking and jolly report writing.

Short Circuit wishes its readers the very best for the coming festivities and the summer break.

Meanwhile, On 3rd November, Jason Clare, the Minister for Education, released a Draft National Teacher Workforce Action Plan.

This was assembled by an impressive working group of representatives from across the education sector.

CMA councillors have been considering a response to the draft, to be fed back via AAMT.

There is a summary of key actions given under the headings:
Elevating the profession,
Improving teacher supply,
Strengthening initial teacher education,
Maximising the time to teach,
Better understanding future teacher workforce needs, and
Better career pathways to support and retain teachers in the profession.

It is likely that CMA will provide comments consistent with its area of relative expertise, namely the mathematics teaching workforce in the ACT.

We suspect that the problem is one that mathematicians would describe as 'hard'.

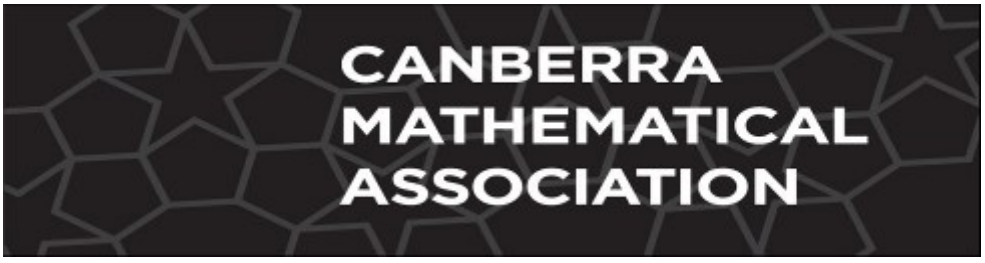
Among the resources for students and teachers that are available online these days, Valerie Barker has drawn attention to the UK online magazine, Chalkdust, published every six months or so.

Issue 16 has just been published; it is free, interesting and very readable (and very British).

Valerie is sure that it will appeal to a number of our CMA members (and their senior students) - its intended audience is 'the mathematically curious'.

Check it out at:
https://chalkdustmagazine.com/

CMA Conference 2023: see next column.



Coming Events:

CMA Conference 2023

Saturday March 18 (almost certainly),

at ADFA.

Since CMA is turning 60 in 2023, the conference theme will be ***All About Sixty.***

If you would like to be a presenter, send us an email.

→ MEMBERSHIP

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

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

Members receive a one-third discount for the CMA conference and attractive rates for CMA professional development events.

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

Inside:

PUZZLES

1 After Alice

A problem that kept Charles Dodgson (the author Lewis Carroll) awake on the night of 19th December 1897, was to find a set of three right angled triangles that had integer sides and equal areas. He found a pair of such triangles, (20,21,29) and (12,35,37), but could not produce a set of three. Dodgson died less than a month later, a failure in this tiny respect.

It turns out that the smallest area of three such triangles is 840. Can you find them?

2 Domino

A domino has from 0 to 6 spots on each end. How many different dominos are there?

CMA UNIVERSITY AWARDS 2022

CMA congratulates these award recipients for their excellent work in their pre-service teacher courses and welcomes them to the teaching profession.

Caitlin Plant [Secondary] (UC),

Natasha Smart [Primary] (UC),

Tanaha Holden (ACU),

Sophie Caputo (ACU)

ABOUT THAT BLACK HOLE

From Brian Goodwin

… a response to Andrew Wardrop's article on a mathematical black hole.

[There was] an interesting problem in the last issue of Short Circuit re Black Holes.

I could not find a reference to it anywhere, so I wrote a Python program to check a few numbers. After 8+ minutes of number crunching, it seems to be true all the way out to at least 5 000 000.

As an extra oddity, the first number less than that limit to take more than 20 loops is 71820 which takes 21 to reach 15.

Many numbers take 20 loops. Up to 5 000 000, my program found 2247 numbers that take 21 loops and none that take more than that.

LITERATURE TO NUMERACY

From Valerie Barker

Literature as a Gateway to Numeracy

This is the title of a Conference presentation I made in August 2015. Interestingly, it coincided with the 150th anniversary of the publication of *Alice's Adventures in Wonderland*, by Lewis Carroll. Many of you will know that this name was actually the nom-de-plume of Charles Lutwidge Dodgson (1832 – 1898), a mathematician, writer and Anglican deacon.

Commonly referred to as *Alice in Wonderland* this book has gone through 157 years of scrutiny: there was the psychoanalytical Freudian analysis of the 1930s, the psychedelic interpretation of the 1960s, and the moral panic of paedophilia of the 1990s. The British copyright on *Alice's Adventures in Wonderland* expired in 1907.

After the Bible, Koran and Shakespeare, *Alice's Adventures in Wonderland* is one of the most frequently quoted and best-known books in the world. The story has been translated into over 125 different languages, including Korean, Japanese, Egyptian and Arabic. Hundreds of editions have been published ever since; countless more children have been introduced to the story through film versions (such as Disney's 1951 *Alice in Wonderland*.

Keith Devlin, a British mathematician, well-known for his book *The Language of Mathemaics* (1998), in a summary of the work of Melanie Bayley (University of Oxford), 2009, *Alice's Adventures in algebra: Wonderland solved* (published New Scientist, 16 December 2009), proposed that Dodgson, a tutor in mathematics (rather than a researcher) and writer, was a "stubbornly conservative mathematician", dismayed by what he saw as declining standards of rigour. Much of the material in the books – the Cheshire Cat, the hookah-smoking caterpillar, the Duchess and baby which turns into a piglet – are satirical responses to the development of abstract (non-symbolic) algebra, non-Euclidian geometries, and

the growing acceptance of "imaginary numbers". It is this "fierce satire" that produced the wit and nonsense, so enjoyed by generations of readers.

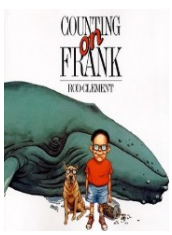
You might like to read this review, from the nRich website https://plus.maths.org/content/language-mathematics

An article in the NCTM journal *Mathematics Teaching in the Middle School* (Vol 12. No 5 December 2006/ January 2007), by Susan B. Taber, *Using Alice in Wonderland to Teach Multiplication of Fractions*, offers an interdisciplinary language arts and mathematics unit for Grades 4 – 8 (USA). As it uses imperial dimensions, it may have limited application as it is, but it offers many opportunities for the development of proportional thinking; although the journal is not readily accessible, I did track down this website which has a PDF of the article available.
http://phelpsmath.weebly.com/uploads/3/1/5/2/3152977/alices_fractions.pdf

Of course, there is so much more to using children's literature to teach mathematics than playing with *Alice's Adventures in Wonderland.*

Primary/Middle School Education

One of the best starting points is the NZMaths website
https://nzmaths.co.nz/picture-books-mathematical-content
which has a lengthy list of picture books, annotated by content and learning stage. Even better, for many of the books, the site offers comprehensive lesson plans and activity opportunities. For example, the popular picture book ***Counting on Frank***, opens children to the world of Fermi problems, those of the *I wonder how many/what if...* kind.

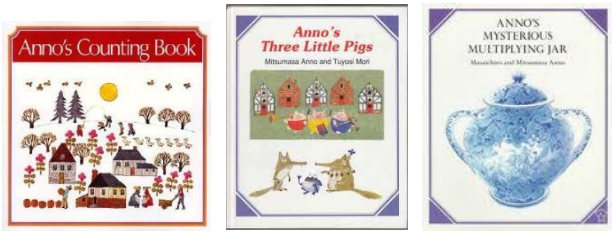


Fermi questions emphasise **estimation, numerical reasoning, communicating in mathematics**, and **questioning skills**. Students often believe that "word problems" have one exact answer and that the answer is derived in a unique manner. Fermi questions encourage multiple approaches, emphasise process rather than "the answer", and promote non- traditional problem solving strategies.
https://nzmaths.co.nz/resource/counting-frank .

You might also like to go to the following American site https://dreme.stanford.edu/news/children-s-books-foster-love-math. There are many more websites, of course.

To get you started, here are some favourites:

Mitsumasa Anno



1. Anno's Counting Book

With a growing column of cubes on the left side of the page, and a large number on the right, Anno shows the development of a small village. On each successive page, spread throughout the year, the village increases by one child, one building, and one tree.

Each picture is full of small stories such as building a railroad, photographing a wedding, or fishing, as well as many examples of the number. There are opportunities for **adding**, such as when three of the geese on the number 4 page lag far behind the other one, and for thinking about **sets,** and other concepts. Although it is a counting book, it is also much more.

2. Anno's Mysterious Multiplying Jar

Inside the jar there was water, and there seemed to be just enough wind to set the water rippling...and suddenly we are inside the jar, on a sea, sailing toward 1 island. On it there are 2 countries. Fascinating pictures tell the story of **factorials** in the first half of the book, and Anno explains them explicitly in the second half.

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NEWSLETTER OF THE CANBERRA MATHEMATICAL ASSOCIATION 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 2023 CMA COMMITTEE

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	Joe Williams	
	Matthew Millikin	Marist College
	Roisin Boadle	Erindale College

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

CAREERS AND MATHEMATICS

Careers & Mathematics can be found at
https://onthejob.education/teachers_parents/Mathematics_Teachers/Careers_Mathematics_Index.htm

Careers and Mathematics

Mathematics is in every job - we all know that but do our students? We will explore a different job and the mathematical activities involving this job from the website "On the Job". Let's have a look at the

Bioinformatics Scientist

Context and relevance: Since the pandemic, we have been bombarded with statistics about COVID. The Bioinformatics Scientist's job is at the heart of these numbers – their analysis and implication. But not just COVID but foot & mouth disease; the work of pharmaceuticals; and, the sequencing of genomes across the world.

Activities for the Classroom:

Activity 1: Bioinformatics: Food Detective

Middle Secondary

This lesson was developed by the University of Edinburgh for students studying Biology in Years 8 – 12. It entails getting the students to learn about DNA barcoding where specific DNA sequences are used to identify different species. The big question is whether pork sausages are 100% pork or not!

Activity 2: Sequence Bracelets

Primary

Students are presented with different species genomes. They are given the sequences and have to then match the chemical bases (A-T or C-G) in a bracelet. This activity relies on concentration.

Activity 3: This activity involves research: The Koala Genome Project – a Listening and Viewing Research Project and is suitable for Biology students. This activity does not directly involved mathematics.

Activity 4: **Cladogram including a Minion classification.**

This is a reasoning activity. Students are given information and they have to work out the relationships between the groups of animals or "things". It is linked to an extended unit of work on Classification (8- 12 lessons).

Activity 5: Bioinformatics practical: the Florida Dentist

This practical is based on a true story about a Florida Dentist accused of infecting his patients with HIV. Students retrieve and align nucleotide sequences and build phylogenetic trees to determine if "he done it"! This is a reasoning activity.

Contact Information

If you are investigating an aspect of mathematics or would like information about a person in that job, please contact me Frances Moore – I would be happy to hear from you.

Frances.Moore@onthejob.education
Mob 0410 540 608

PUZZLE SOLUTIONS from Vol 13 No 11

1. Ancient dice

Determine the number of throws of a pair of fair dice necessary to give at least an even chance of throwing a double 6.

Bernoulli's solution:

In an experiment, let the number of possible outcomes be c, and let the number of unsuccessful outcomes be b. (In this case $c = 36$ and $b = 35$.) In some number n of trials of the experiment, there are c^n sequences of outcomes of which b^n contain no successes.

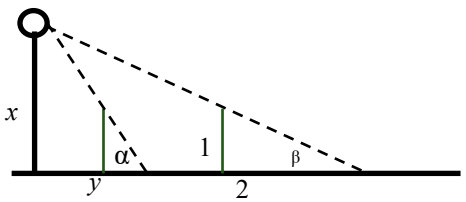
For an even chance, we want the number of successful outcomes to equal the number of unsuccessful. So, $c^n - b^n = b^n$. That is, $c^n = 2b^n$. Taking logs we obtain $n = \log 2 / (\log c - \log b)$. For the given values of c and b, we find $n = 24.6\ldots$ Hence, 25 throws are needed for an at least even chance.

2. Lamp light

One night, Jakob decided to measure the height of a certain lamppost. It was too high to measure directly, but he had in his possession a one metre measuring stick marked in centimetres.

He held the stick vertically near the post so that by the lamp at the top, the stick cast a shadow of length 70 cm on the ground. He marked the point of the shadow tip with a small stone. Then, keeping in the same line, he moved the vertical stick two metres further out from the stone. He found that the shadow length increased to 150 cm.

From these measurements he was able to calculate the height of the lamppost.



By similar triangles,

$x/y = 100/70$ and

$x/(y + 2) = 100/150$

Therefore, $y = 7x/10$ and so, after substitution and simplification, $x = 60/24 = 2.5$ m.

3. Parts

I divide 10 into two parts. Then, I divide the first part by the second and the second part by the first. The sum of the quotients is 13/6. Find the parts.

Call the two parts a and b. Then, $a + b = 10$ and $a/b + b/a = 13/6$. Thus, $a = 10 - b$ and therefore, after substituting for a in the second equation and solving a quadratic, we have 4 and 6 for the two parts.

CONTINUED FROM PAGE 3

3. Anno's Three Little Pigs

Socrates the wolf is trying to locate one of the three little pigs. He explores **combinations and permutations** in the process. Again the mathematics is explicitly explained.

Useful references

http://nzmaths.co.nz/picture-books-mathematical-content

http://research.acer.edu.au/cgi/viewcontent.cgi?article=1006&context=digest

http://www.slj.com/2010/05/collection-development/as-easy-as-pi-picture- books-are-perfect-for-teaching-math/

http://kasmana.people.cofc.edu/MATHFICT/all.php (A list of mathematical fiction).

Ward, R.A. (2009). *Literature-Based Activities for Integrating Mathematics with other Content Areas (Grades 3-5).* Pearson