SHORT CIRCUIT

Newsletter of the Canberra Mathematical Association INC

VOLUME 12 NUMBER 12 DECEMBER 2021

NEWS AND COMMENT

On November 25, a brief annual general meeting of the CMA was held in the foyer at the CIT Reid restaurant, after which those attending proceeded to a very pleasant annual dinner.

The meeting elected a new president, Aruna Williams who teaches at Erindale College; and a new treasurer, Jane Crawford from Brindabella Christian College. The full list of CMA councillors for 2022 is on page 4 of this newsletter.

It was noted in the meeting that the possibility exists to bring in further councillors from the membership during the year should the need arise.

As is the custom, CMA made awards at the dinner to four outstanding education students headed for the primary and secondary sectors. They are, from the University of Canberra—Matthew Nesham and Amy Uebergang, and from the Australian Catholic University—Beth Patterson and Olivia Hall. On behalf of CMA, Short Circuit wishes them, and all recently graduated new teachers every success in their new careers.

A big *well done!* goes to all our readers who have continued to do their jobs as teachers in this trying year, both remotely and face-to-face. We wish you a refreshing break before the teaching cycle begins again.

CANBERRA MATHEMATICAL ASSOCIATION

Inside:

Coming Events:

2022 CMA conference

Wednesday Workshops:

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. Inside or out

Three points are chosen at random on the circumference of a circle. What is the probability that the tangents drawn at those points intersect to form a triangle that encloses the circle?

2. Pascal's triangle

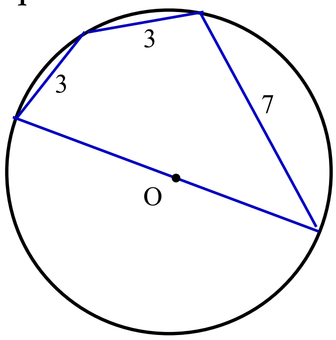
Pascal's triangle displays in its rows, the coefficients that arise when a sum of two terms is raised to a power, but it has other nice patterns as well.

Suppose the product of the numbers in row n is labelled P_n . Starting from $n = 2$, we can form the expression

$$\frac{P_{n-1}P_{n+1}}{P_n^2}$$

and use it to derive a sequence beginning with {2, 2.25, 2.37.., 2.44.., …}. It turns out that these numbers are increasing but they never get as far as 2.72. In fact, the sequence converges to the remarkable number $e = 2.718…$. How might this be explained?

3. Cyclic quadrilateral



Find the radius of the circle. (Consider using Ptolemy's theorem.)

4. Ptolemy's Theorem

The 2nd century Greek astronomer Ptolemy, from Roman ruled Egypt, used the fact that *In a cyclic quadrilateral, the sum of the products of the opposite sides is equal to the product of the diagonals.*

This theorem is stronger than Pythagoras' theorem in the sense that the latter can be derived from it. Hence, we should not attempt to prove Ptolemy's theorem using Pythagoras. There are various modern proofs, but the question is, *How might Ptolemy have proved it?*

SINES IN TRANSLATION

From Ed Staples

Etymology

The word *sine* used in trigonometry today has a fascinating etymology.

Sanskrit, the language of ancient Hindu texts, is a classical language of India. When Hindu literary works were translated into Arabic, the vowels in words were dropped.

The Sanskrit word for 'half-chord' is *jya-ardha* (literally *chord-half)* although the great fifth century Indian mathematician/astronomer Aryabhata was in the habit of abbreviating it to either *jya* or else replacing it with the synonym *jiva*, pronounced as '*gee-bah*'.

Many years later, in the twelfth century, an English Arabist by the name of Robert Chester, was tasked with translating some of Aryabhata's writings into Arabic. For the word *jiva*, he dropped the vowels as a matter of course but then wrote *jb* instead of *jv*, because of the way it was pronounced. Years later, this simple error had huge consequences.

For, when other writers were translating the work into Latin, they assumed that the word *jb* derived from another word *jaib* - Sanskrit for a woman's bosom, and by extension, a fold as in a toga over a breast, or a bay or inlet. The Latin equivalent of *jaib* was *sinus* which in English became *sine*.

So, a Sanskrit synonym of a word meaning half-chord, was mistranslated over centuries and across three languages to become a word meaning a breast!

Reference: Victor J Katz: A History of Mathematics, an Introduction, 3rd Edition

[This is part one of two pieces on *sines* contributed by Ed Staples. The second will appear in the next issue.]

IT'S ONLY BUSINESS

From the editor.

In a recent article from a journal devoted to Australian music, the author Trevor Cobbold, National convenor of the Save Our Schools organisation, exposed some seriously disturbing behaviour by certain elite private schools.

Cobbold's article, *BratKeeper: profitable private schools purloin JobKeeper, pandemic payments too*, can be accessed at this link.

To quote Cobbold: …*figures presented to a Parliamentary committee show that 700 private schools, including many of Australia's most exclusive ones, raked in $750 million in JobKeeper payments while running surpluses in the millions.* And there is more, which the reader can discover by reading the article.

A line from Coppola's *The Godfather* film series, springs to mind: *It's not personal, it's only business*. The sociopathic attitude expressed in these words comes from the widely held assumption that it is the legitimate nature of business to be self-serving and opportunistic with no regard for wider consequences.

Unfortunately, the enterprise of education has become, from the perspective of the boards of the schools mentioned in Cobbold's article, just such a business. Apparently, these boards have behaved in the expected egregiously sociopathic, although legal, manner.

The debate about state aid for private and faith-based schools in this country has been fluctuating tidally for a very long time, with plausible arguments on all sides. But this newly revealed behaviour is something more. It threatens to wash away any pretence of equity in our education system.

The article begins with a flourish: *Blessed are the rich, for theirs are the taxes of the poor!* Even if only slightly true, we must ask what conjuring tricks, what deceptions, what spin has facilitated this escalation, and what we mere foot soldiers in the education industry can do about it.

Reproduced below is the painting "At the door of the school" from 1897 by the Russian Nikolai Bogdanov-Belsky. It speaks of the difficulty of gaining an education experienced by a peasant child in Tsarist Russia. It has a prophetic feel about it.

NATURE PLAY

The fourth book in Bruce Ferrington's *miniMaths/ Nature Play* series is on its way. Bruce is planning a workshop soon as part of the writing process.

How and where this will occur is yet to be determined but information about it will be circulated in due course.

The *miniMaths* series has been supported by grants from the Council of ACT Education Associations (COACTEA).

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 2022 CMA COMMITTEE

President	Aruna Williams	Erindale College
Vice Presidents	Bruce Ferrington	Radford College
	Paul Kruger	Marist College
Secretary	Valerie Barker	
Treasurer	Jane Crawford	Brindabella Christian College
Membership Sec.	Paul Turner	
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	Theresa Shellshear	Australian Catholic University
	Heather Wardrop	
	Andrew Wardrop	
	Sue Wilson	
	Yuka Saponaro	
	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.

Short Circuit is edited by Paul Turner. **ISSN 2207-5755**

Find us on Facebook

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

SEEN AT THE AGM

With the prize-winners: Left to right—

Aruna Williams (president),

Amy Uebergang (UC, primary)

Valerie Barker (secretary)

Matthew Nesham (UC, secondary)

(Beth Patterson and Olivia Hall (ACU) were not able to attend.)

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PUZZLE SOLUTIONS from Vol 12 No 11

1. Inheritance

Divide the 100 *écus* in the ratio 1:2:4 so that the daughter gets 14, the mother gets 29 and the son gets 57 (ignoring fractional parts).

2. Missing digits

The required consecutive numbers must have 3 digits to make an 8-digit product because three consecutive 2-digit numbers have a product with at most 6 digits while the product of three consecutive 4-digit numbers has at least 10 digits. Moreover, the first digit of the 3-digit consecutive numbers must be either 2, 3 or 4 to get an 8-digit product.

The product ends in 0, so the consecutive numbers could end in ..3, ..4, ..5 or ..4, ..5, ..6.

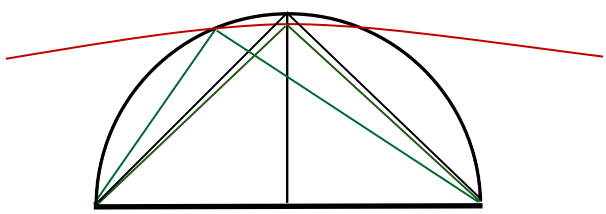
Since the product is a little more than 93 000 000, the consecutive numbers must be somewhat greater than 453, a number near the cube root of the product. The numbers 453, 454 and 455 meet the requirements, and their product is 93 576 210.

3. Pythagoras forever

We have $a^2 + b^2 = c^2$ where a is a prime number. So, $a^2 = c^2 - b^2$, which has factors $(c + b)$ and $(c - b)$. Since a is a prime, $c - b = 1$. Thus, $a^2 = b + c$.

4. Ellipse and circle

A loop of string of length 24 cm can be pulled into a triangle shape with one side 10 cm. The other sides must be x and $14 - x$. By varying x between 0 and 14, the vertex opposite the 10 cm side traces out an ellipse.



When $x = 6$, (or $x = 8$) the triangle has sides 6, 8, and 10, and hence is right-angled. Thus, the vertex of the triangle lies on the circumference of the circle with diameter 10 and also on the ellipse.

When $x = 7$, the vertex of the triangle is slightly inside the circle, and the triangle is isosceles. An isosceles right triangle with hypotenuse 10 has legs $10/\sqrt{2}$. So, $7 < 10/\sqrt{2} = 5\sqrt{2}$. Hence, $\sqrt{2} \approx 7/5$.