SHORT CIRCUIT

Newsletter of the Canberra Mathematical Association INC

VOLUME 14 NUMBER 3 MARCH 2023

NEWS AND COMMENT

The risk of personal data being stolen from computer and other systems must be a concern for most of us these days. While the danger to the CMA membership list seems slight, we have nevertheless substantially reduced the amount of information about members that we collect via our membership forms.

The new forms will appear on the CMA website in the next few days.

A reminder will be sent out shortly, with a new membership form attached, to people and institutions who were CMA members in 2021 or 2022 but who have not yet renewed their membership. In view of the earlier date of the CMA conference this year, we imagine that timely renewal of memberships will seem like a good idea.

The CMA conference is on Saturday 18th March.

See you there!

CANBERRA MATHEMATICAL ASSOCIATION

Coming Events:

CMA Conference 2023

Saturday March 18 at ADFA.

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

Book through Trybooking.

See page 5

→

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.

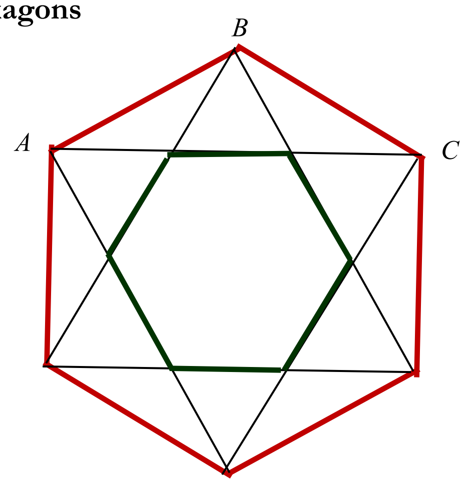
Members receive a one-third discount for the CMA conference and attractive rates for CMA professional development events.

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

Inside:

PUZZLE

Hexagons



The larger (red) hexagon is regular. We made a star-shape by connecting every second vertex by lines. The smaller (green) hexagon appears as a result.

1. How can we be certain that the smaller hexagon is also regular?
2. Imagine circles drawn through the vertices of each hexagon. How do the radii of the circumscribing circles compare?
3. If the smaller hexagon has perimeter 6, what is the perimeter of triangle ABC?

EDUARD LILL

From Ed Staples.

How to solve a Quadratic Equation with a Set Square!

Eduard Lill (1830-1900) devised a curious method for solving quadratic equations with, of all things, a set square!

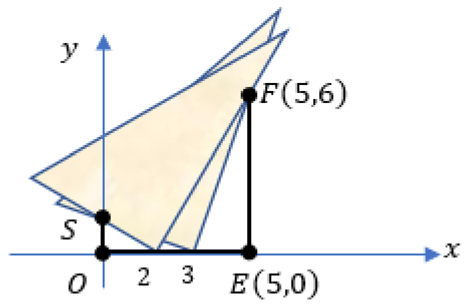
The idea he struck upon was to first 'represent' the equation $ax^2 + bx + c = 0$, $(a > 0)$ as a 'zig-zag' line. Then using a set square placed strategically on that line, the roots immediately reveal themselves.

The technique is perhaps best explained if we construct things on a set of equally scaled (x, y) coordinate axes. So, with that in mind, there are three simple steps to a solution.

1. Mark in points $S(0, a)$, $E(-b, 0)$ and $F(-b, c)$.
2. Draw the zig-zag line $SOEF$ where O is the origin.
3. A set square is now used to locate the roots. The set square is positioned so that two things happen. Firstly, the right-angle corner is somewhere on the x-axis, at say R. Secondly, the two edges that form the right angle are each crossing over points S and F.
(Often you can find two correct positions for R. We might call these R_1 and R_2 when that happens).

Surprisingly, the x-values of the Rs are the solution(s) to the quadratic equation.

Let's demonstrate using $x^2 - 5x + 6 = 0$. First, plot $S(0, 1)$, $E(5, 0)$ and $F(5,6)$, as shown in the diagram below. Then, after sliding a set square around for a while, the two roots $R_1 = 2$ and $R_2 = 3$ are eventually found.

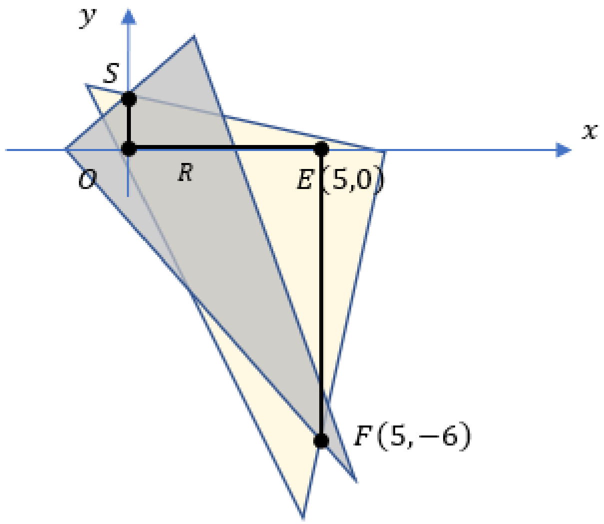


How clever is that!

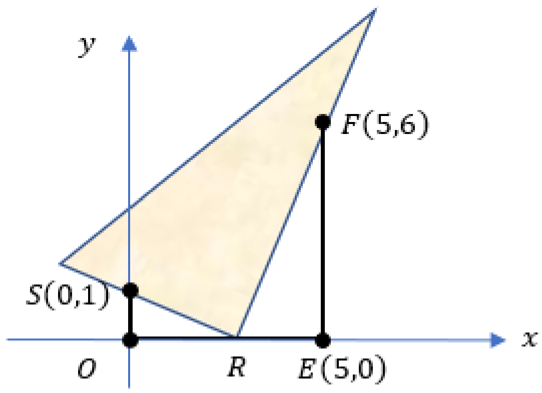
Of course, the zig-zag line will look different for different coefficients. It doesn't really matter though – so long as you satisfy the two requirements above, then the roots, if they exist as real numbers, will be found at the right-angle vertex.

Furthermore, sometimes you'll find R outside of the interval OE, and sometimes it will be impossible to find any solution no matter how you position the set square. There is so much to investigate around this technique.

For example, here's the solution diagram for the quadratic equation $x^2 - 5x - 6 = 0$. Can you work out the roots?



I guess the bigger question to contemplate is why it works. Suppose we try to solve for *R* in our first example, by placing the set square in position on the *x*-axis:



Note that the triangles ΔROS and ΔFER are similar.

If we let $|OR| = x$ then we have by equal ratios that $\frac{5-x}{6} = \frac{1}{x}$

When rearranged, this becomes

$$x^2 - 5x + 6 = 0.$$

Why not introduce Lill to your classroom? There's plenty of information on the net for you to obtain a better understanding of his technique, not only for quadratics, but also for higher degree polynomial equations as well.

E.S.

TEACHER WORKFORCE DATA

The Australian Institute for Teaching and School Leadership (AITSL) has launched an Australian Teacher Workforce Data (ATWD) initiative, with the intention of building an evidence base to inform decisions about the future of the teaching profession.

The aim is to collect *initial teacher education* data and *teacher workforce* data from across Australia, to provide information about

- How many teachers there are
- How many graduates get jobs
- The types of contracts teachers are employed under
- Teacher career paths and experiences
- How many teachers are entering and leaving the profession.

The ATWD Key Metrics Dashboard provides digital access to the data.

BUSINESS ADMIN

The Australian Curriculum '… setting the expectations for what **all** young Australians should be taught, **regardless of their background or where they live**.'

In the field of Business Administration, it is widely held that *without diversity innovation is impossible*.

Can education afford to ignore this principle?

JOHN DEWEY, 1895

In the opinion of John Dewey, of great repute among librarians,

> It is … advisable that the teacher should understand, and even be able to criticize, the general principles upon which the whole educational system is formed and administered. He is not like a private soldier in an army, expected merely to obey, or like a cog in a wheel, expected merely to respond to and transmit external energy; he must be an intelligent medium of action.

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.

Sixty years ago

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

President	Aruna Williams	Erindale College
Vice Presidents	Bruce Ferrington	Radford College
	Jo McKenzie	ACT Education Directorate
Secretary	Valerie Barker	
Treasurer	Jane Crawford	Brindabella Christian College
Membership Sec.	Paul Turner	
Councillors	Peter McIntyre	University of NSW Canberra
	Theresa Shellshear	Australian Catholic University
	Heather Wardrop	
	Andrew Wardrop	
	Sue Wilson	
	Yuka Saponaro	Melba Copland Secondary School
	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.

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

Find us on Facebook

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

CMA conference 2023

All about 60

Saturday March 18
Australian Defence Force Academy (UNSW)

The keynote speaker for the Neville de Mestre Memorial Lecture will be Dr Merrilyn Goos (University of the Sunshine Coast)

Registration Fees: members $100, non-members $150, concession $50.

Book through Trybooking

Contact: canberramaths@gmail.com

Now is a good time to renew your CMA membership in order to benefit from the member discount rate. Go to http://www.canberramaths.org.au/

CAREERS AND MATHEMATICS

Careers and Mathematics

… 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

M Middle H 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

P 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.

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

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 14 No 2

1 Heterosquares

A heterosquare is defined as a $n \times n$ square array using n^2 consecutive numbers starting from 1, such that every sum of a row, column or diagonal is different.

In a 2 × 2 array there are 6 rows, columns and diagonals. Also, there are 6 pairings of the four digits 1, 2, 3, 4. However, not all the pairings have a different sum. In particular, 1 + 4 = 2 + 3. So, there are not enough sums to form a 2 × 2 heterosquare.

A 3×3 example:

9	8	7
2	1	6
3	4	5

2. Typos

It is the case that 34 × 86 = 43 × 68.

In general, with digits *a, b, c, d,* we require $(10a + b)(10c + d) = (10b + a)(10d + c)$. That is, after simplifying, $99(ac - bd) = 0$ and therefore, $ac = bd$.

The example works because 3 × 8 = 4 × 6.

Similarly, because 3 × 2 = 6 × 1, we have 36 × 21 = 63 × 12 and so on.

FREE GROK

Grok Academy information technology resources are now free for all Australian schools, teachers and students! This is thanks to the generous support of WiseTech Global, (a company that creates supply chain software for logistics companies).

An impressive schedule of courses is available, covering coding, cryptography and cybersecurity, forensics, and other IT topics—at all levels.

FREE TEXTHELP

The partnership arrangement between AAMT and Texthelp has ended.

However, the suite of resources available through the Texthelp organisation is still free for teachers (but not for students). These include *Equatio* for numeracy and *Read&Write* for literacy.