SHORT CIRCUIT

Newsletter of the Canberra Mathematical Association INC

VOLUME 13 NUMBER 11 NOVEMBER 2022

NEWS AND COMMENT

Notice of the
Annual General Meeting of the
Canberra Mathematical Association.

The 2022 AGM of the CMA will be held on Thursday 17th November at 6:00 p.m. immediately before the annual dinner, at CIT Reid campus. Current and prospective CMA members are warmly invited to attend.

The cost for dinner guests is $35 payable by direct deposit to the CMA bank account prior to the event.
The account details are:
BSB 325-185
03408704 Canb Math Assoc.

Please tell us that you plan to attend by sending an email message to
canberramaths@gmail.com
before 10 November.

ICME 15

The 15th International Congress on Mathematical Education is to take place in Sydney in 2024, 7 - 14 July.

For information, go to the ICME 15 website.

Coming Events:

AGM and Dinner, Thursday 17th November, CIT Reid, 6:00 p.m.

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.

CANBERRA MATHEMATICAL ASSOCIATION

Inside:

PUZZLES

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.

(This question was answered by Christian Huygens in 1657 and, using a different method, by Jakob Bernoulli in 1713.)

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. Can You?

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.

CLEVER INSECT

New Scientist No. 3395 of 16th July 2022, reports that the paper wasp *Polistes* understands the transitive inference, if A < B and B < C then A < C.

Mind you, we doubt that the insect would express it quite that way.

We wonder at what age humans are usually expected to grasp this idea.

REFLECTIONS

From Andy Wardrop

As I considered the work the CMA did in 2022, it occurred to me that three people who contributed to the association passed away this year.

Audrey Guy (20/05/37 – 13/05/22) was a dedicated teacher who worked hard for her students. Her love of mathematics and interest in curriculum issues was admired by her colleagues. She was well known as a prolific writer of letters to the editor of The Canberra Times. What is less well known is that she was active in the council of the CMA in the late 80s and early 90s and she was heavily involved in the drafting and adoption of the constitution of the CMA.

John Gordon (24/05/46 – 26/07/22) was active in the CMA for many years. He was an excellent teacher and mentor of inexperienced teachers. He wrote articles for the CMA hard copy journal *Circuit* and was the editor in 1980. In 1994 he was the President of the CMA.

Neville De Mestre (15/06/38 – 24/05/22) was a lecturer in Mathematics at RMC Duntroon (1962 –

85) and ADFA (1986 – 89). He was passionate about Mathematics teaching and problem-solving in primary school and lower secondary school. He was chairman of the school board at Campbell Primary School (1976 – 79) and Campbell High School (1981- 83) where his three daughters attended. In 1976 he obtained a large grant from the newly formed Schools Commission to establish and staff the ACT Maths Centre at Campbell Primary School. Bea Duncan was appointed as the teacher-in-charge and together they wrote 100 tasks for upper primary school students (but ultimately became popular with students of all ages). Neville was the director until 1980 when the Centre was subsumed by Questacon and became part of Questacon Travelling Maths Centre.

Neville's work with the CMA involved a subcommittee dealing with middle school problem-solving and forming a moderator group at RMC Duntroon to provide feedback and support to The Australian Mathematics Competition which was, in the early days, run by the CMA. He was a prolific writer and produced several good books as well as over 100 articles in AAMT journals *AMT* and *AMEJ*. If you want to find out more about Neville and his work, especially after he moved to Bond University in 1990, I have included some references below and I recommend them to you.

(2022) ***AMEJ*** Vol. 4 Ed. 1 pp 4-5 *Vale Neville De Mestre*

https://sites.google.com/site/pjt154/home/a7-awards/de-mestre

https://mathematicscentre.com/taskcentre/tc_begin.htm

Andrew Wardrop

ANOTHER BLACK HOLE

From Andy Wardrop

The Tedious Number 15

Last year I wrote three articles in *SHORT CIRCUIT* about mathematical black holes. What is a mathematical black hole? It is hard to explain in theoretical terms but the idea is easy to convey using examples. Basically, you choose a number, apply a well-defined mathematical process to that number and then apply the process to the answer. The process is repeated until you get to a point where you can't change the answer or you get into an endless loop of answers. As in the astronomical properties of a black hole in space, you cannot escape from a mathematical black hole. In the following example the black hole is 15 but it can take a long time to get there.

Take any integer and write down all its divisors including 1 and itself. Add up the digits in the divisors and then repeat the process as many times as you can.

Example: I choose 12 and so the divisors are 1, 2, 3, 4, 6 and 12 with digit sum 19. Then, 19 has divisors 1 and 19 with digit sum 11. This has divisors 1 and 11 with digit sum 3. Then,

$1 + 3 = 4$

$1 + 2 + 4 = 7$

$1 + 7 = 8$

$1 + 2 + 4 + 8 = 15$

$1 + 3 + 5 + 1 + 5 = 15$

We are at the black hole of 15 and it took 7 runs to get there.

Does it have to be 15? Are there other possible end points? I haven't found any – see how you go.

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

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	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

CAREERS AND MATHEMATICS

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

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 Naval Officer.

Context and relevance: The Navy has a range of career choices and promotes a Gap Year experience too. The Navy is suitable for a range of students and will train them on the job.

Activities for the Classroom:

Activity 1: Australian 'Battleship'

Primary Middle

In this activity, students are to create their own game of 'Battleship' using the Navy's own ships after investigation. There is graphing involved.

Activity 2: Knots & Knots: What Sailors ought to know!

Primary Middle

Students are to study a range of knots, work out as a class the simplest to the hardest, select one knot to practice; create the knot 3 times – collate all the times as a class; graph the results and compare these results to their earlier conjecture.

Activity 3: Telescoping Periscope (from Try Engineering.org)

Primary Middle Secondary

Students are to design and build their own periscope and test it out.

Activity 4: Mental Mathematics for Maritime Warfare Officers, Pilots & Aviation Warfare Officers (developed by Defence Jobs)

Middle Secondary

Students are to complete mental calculations relating to ships that the Navy uses in training Officers.

Activity 5: Navy Cadets: STEM Activities

Primary Middle Secondary

The Bebras Challenge is available on the CSIRO's Digital Careers Program. The Navy uses this program to promote the cadets' Critical and Creative Thinking. There are challenging puzzles (with answers) for students to complete.

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 10

1. Near enough

The following irrational numbers are all quite close to integers: $e + 2\pi$, $\pi + 92\varphi$, $10\varphi^e$, where e is the base of natural logarithms, π is the circle constant, and φ is the golden ratio $(1 + \sqrt{5})/2$.

Which of these best approximates its nearby integer?

In decimal form the three numbers are respectively 9.001467… , 152.000719… , 36.990253… and the differences from their nearest integers are respectively 0.0014… , 0.0007… , and 0.0097… . So, the second number, $\pi + 92\varphi$ is best.

2. Could do better

The irrational number φ is near the rational number 809/500, but it is also not far from 233/144. Make a case for choosing one approximation over the other.

The rational number 809/500 is the decimal 1.618 while φ expanded as a decimal is 1.618033989… . On the other hand, 233/144 written in decimal form is 1.618055556. The first fraction is a smidgen more than 0.00003 away from its target while the second is slightly more than 0.00002 more than the value it approximates.

Thus, for a three-digit denominator 233/144 is better than 809/500, but the latter is more convenient as a decimal approximation.

3. Exponential *x*

There are three values of x that satisfy the following equation.

$$4^x + 7^x + 11^x = 1^x + 2^x + 9^x + 10^x$$

If the equation is modified to

$$4^x + 7^x + 11^x = 2^x + 9^x + 10^x$$

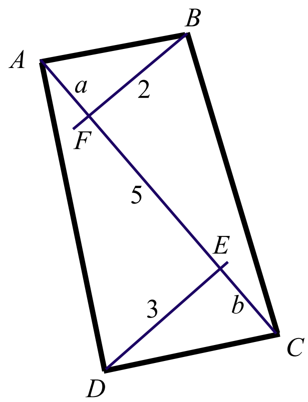
there are still three solutions, but they are much harder to find and may be impossible to write down.

These equations are known as 'multigrades'. There is some not-too-difficult theory about how they can be generated for known solutions, but to solve one there seems to be no better strategy than 'guess and check'. It is possible to construct multigrades with any whole number of integer solutions.

The first equation has solutions $x = 1, 2, 3$. If the function $y(x) = 4^x + 7^x + 11^x - (1^x + 2^x + 9^x + 10^x)$ is plotted on a graphic calculator, the solutions become visible and it is clear that there are no others.

The second equation has a solution $x = 0$, another at slightly more than $x = 2$, and another at slightly less than $x = 3$. There are no others.

4. Survey



The angles at A, C, E and F are right angles. The surveyor has not recorded the distances a and b. However, it is still possible to find the area of the quadrilateral, given the right angles at A and C.

Given that there are right-angles at A, C, F and E, we deduce that angles DCE and CBF are equal, which makes triangles DCE and CBF similar. In the same way, we see that triangles ABF and DAE are similar. Thus, $b/3 = 2/(b + 5)$ and $a/2 = 3/(a + 5)$. That is, $b^2 + 5b = 6$ and $a^2 + 5a = 6$ with positive solutions $a = b = 1$.

The area is then $(21 + 14)/2 = 17.5$.