SHORT CIRCUIT

NEWS AND COMMENT

CMA members and prospective members are invited to attend the **Annual General Meeting** of the association, which will be held on 11 November in a form yet to be determined.

The usual dinner will not occur but the AGM will go ahead, either as a small gathering or online. This will be arranged depending on the how many people indicate that they wish to attend.

To this end, we ask that those desiring to attend respond to this invitation no later than 12 October. It will not be possible to accommodate anyone who makes a later decision, so please let us know soon. We also need to know whether you wish to nominate for a position on the CMA council. Your response to the [CMA email address](#) is keenly anticipated.

In this edition we continue the series of articles by Heather Wardrop about strategies involving language in mathematics. All readers who have ideas about pedagogy derived from their experience in the classroom, are encouraged to consider submitting a piece to Short Circuit.

CMA members, Bruce Ferrington and Paul Kruger, two well-known maths teachers from Canberra with extensive classroom experience, have launched a new initiative.

Connecting Maths is a series of six online workshops that has been running this term to support teachers across the ACT to find great ways to motivate and engage students in effective learning.

The workshops assemble some essential pieces – teacher empowerment, student engagement, pedagogical awareness and academic research – to build a strong maths program. The workshops have been fully subscribed and there has been an enthusiastic group of regular attenders each week. There is the possibility that the Connecting Maths project will continue into Term 4. If you are interested in finding out more, see the website www.connectingmaths.com

Connecting Maths
- Putting the pieces together

See page three for news of the National Mathematics Summer School. Applications are invited.

We foreshadow a new local mathematics competition for schools that CMA hopes to launch in 2021. Successful students will be able to enter the National Mathematics Talent Quest, which has not been possible hitherto.

CANBERRA MATHEMATICAL ASSOCIATION

Coming Events:
CMA conference: CANCELLED.

CMA AGM: 11 November, 2020.

Wednesday Workshop:

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   Discovery

A 12-year old Nigerian student, Chika Ofili, discovered a test for divisibility by 7 during his school holidays. The trick, he explained, is to multiply the last digit of a number by 5 and then add the result to the number formed by the remaining digits. If the sum is divisible by 7, then so is the original number. For example, 133 leads to 13+5×3 = 28, which leads to 2+5×8 = 42, then 4+5×2 = 14, then 1+5×4 = 21, and finally, 2+5×1 = 7. Eventually, for any multiple of 7, the process terminates with either 7 or 49.

Explain why the test always works.

2   Horse sense

Mr J has 25 horses, and he wants to pick the three fastest. He can only run five of them at a time as he can only engage 5 riders. Without timing their runs, what is the minimum number of races required to find the three fastest horses?
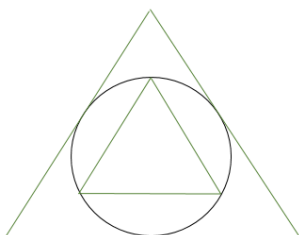
3   Rotation
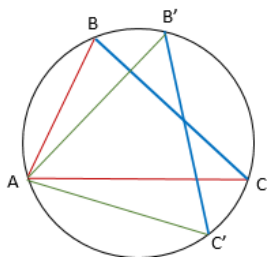
Chords BC and B'C' are equal. Each subtends an angle at point A on the circle. Are the angles at A equal? Explain your answer.

4   Tricky triangle

If the outer triangle has area 1 unit, what is the area of the inner triangle?
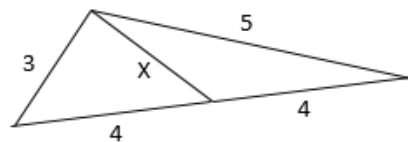
5   To the moon and back

To a question from Houston, Neil Armstrong may perhaps have replied: 'No, it is open on one position!'. What is interesting about this statement?

6   Time twist

Which one of these words does not belong: BRING, BUY, CATCH, DRAW, FIGHT, SEEK, TEACH, THINK?
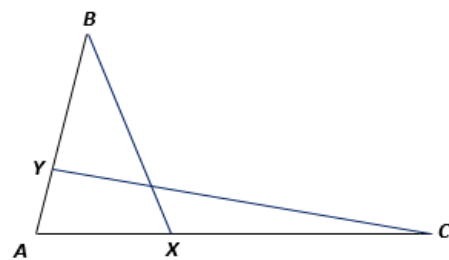
7   Invisible X

How long is the median X in this triangle?

8   In the land of the medians

(This problem is difficult. Ideas about vectors could be useful. Let us know if you find a nice solution.)

In the diagram, point X divides AC and Y divides AB, both in the ratio 1:2. The point of intersection of XB and YC divides each of these lines in some ratio. Is the ratio the same for both lines? If so, what is it?

NMSS

Due to the risks associated with the COVID-19 epidemic, Prof. Benjamin Burton, Director of the National Mathematics Summer School, has announced changes to the plans for the 2021 event. So far, it has been decided that:

NMSS 2021 will be run in state-based centres (not in a central location), with lectures streamed nationally, tutorials run face-to-face with local mathematicians, and an online programme that will as far as possible maintain the spirit and heart of this national event.

It will not be residential. We will do our best to make NMSS accessible to regional students. This may end up with some students travelling to their local capital with a parent or guardian, and with some students attending entirely online.

Some of the smaller states will have a larger quota, in the hope that we can make a full tutorial group locally.

The cost will be significantly less than usual.

Students going into year 12 in 2021 who are strong in mathematics can download a self-nomination form and a school nomination form from the CMA website. These should be submitted without delay.

AAMT

Dr Duncan Rayner is the Chief Executive Officer of AAMT. He writes:

AAMT would like to connect with Canberra maths teachers who may be interested in contributing to the association. We have a range of tasks we need help with, including writing Maths300 lessons, researching and drafting position papers, typesetting journal articles, reviewing resources, social media postings and advising on programs. We can offer casual rates of pay. If anyone is interested, please contact Duncan Rayner at drayner@aamt.edu.au.

The work we are doing on position papers may be good for a postgraduate student who would like to contribute to a publication.

CODING COMPETITION

See the Texas Instruments site for details and to enter.

PHOTOGRAPHIC COMPETITION

ATAR

Geoff Masters, Chief executive, ACER, asks: *Is ATAR necessary?*

From *Teacher*, 3 August 2020.

"The Australian Tertiary Admissions Rank (ATAR) dominates senior secondary schooling in Australia. For many parents and students, it is the principal measure of 13 years of learning and the key indicator of a student's academic performance and future potential. It takes precedence over information provided on senior school certificates; drives a wedge between ATAR and non-ATAR studies in the senior years; differentially values university courses according to their ATAR cut-offs; and is used by schools in their marketing campaigns and by the media for comparing schools. And yet, it was not designed for any of these purposes."
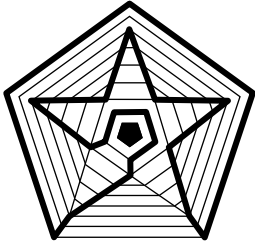
NEWSLETTER OF THE CANBERRA MATHEMATICAL ASSOCIATION INC

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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 2020 CMA COMMITTEE

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Short Circuit is edited by Paul Turner.

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

LANGUAGE STRATEGIES FOR MATHEMATICS—STRATEGY 3

By Heather Wardrop

<u>The Three-level Guide</u>

This strategy can be used at any level – primary, high school or college. Students enjoy the change in activity, and they can explore social issues through mathematics. At college level it can serve as good practice for the A.S.T.

In this article, intended as generic information, the features of mathematical language that I have previously outlined are clear. You will find all of them.

I took the following piece as an example from the Cancer Council site. It's a good exercise to make up your own questions about the extract, using the three levels explained below. Otherwise, set the students to construct the questions as a homework task. They could work in groups in class and then swap and do them.

About SPF50+ sunscreen

Sunscreen helps reduce your risk of skin cancer

In November 2012, the Therapeutic Goods Administration announced a new standard for sunscreens sold in Australia, increasing the maximum sun protection factor from SPF30+ to SPF50+.

The higher SPF offers the same level of Ultraviolet B (UVB) protection, with added Ultraviolet A (UVA) protection.

UVB is the major cause of sunburn and increased skin cancer risk, while UVA contributes to ageing of the skin, as well as higher skin cancer risk.

What's the difference between SPF30 and SPF50+?

Many Australians are surprised to learn that SPF50+ only offers marginally better protection than SPF30. SPF50+ filters out 98% of UVB radiation, while SPF30 blocks out 96.7% of UVB.

SPF50+ sunscreen still needs to be applied liberally as with any other sunscreen – see our recommendations below on how to apply it properly.

What we recommend

Cancer Council recommends using sunscreen every day on days when the UV Index is forecast to be 3 or above. Sunscreen should be part of your daily morning routine on these days.

Cancer Council recommends using any sunscreen that is labelled broad-spectrum, water-resistant and SPF30 or above. Remember to also check the expiry date, as products that are past their use-by date will not give proper protection.

Sunscreen should be applied 20 minutes before going outdoors. For an adult, recommended sunscreen application is 5mL (approximately one teaspoon) for each arm, leg, body front, body back and face (including neck and ears). That equates to a total of 35mL (approximately seven teaspoons) for a full body application. It needs to be reapplied at least every two hours, irrespective of the water resistance of the sunscreen, and should be reapplied after swimming, sport, sweating and towel drying.

Lastly, remember that sunscreen should always be used in combination with other sun protection measures, including wearing sun protective hats, protective clothing, sunglasses, and seeking shade.

What do all the terms mean?

- **SPF:** The SPF (Sun Protection Factor) of a sunscreen is a measure of how well it protects the skin from sunburn. Sunscreens need to be applied liberally to achieve the SPF protection claimed on the label.
- **Water resistant:** Does not come off the skin during swimming or exercise, provided it is not wiped off. While a label may state a sunscreen is '4 hours water resistant', sunscreen still needs to be applied every two hours to maintain the same level of protection.
- **Broad-spectrum:** Broad-spectrum sunscreens filter both UVA and UVB rays. UVB is the principal cause of sunburn, but both UVA and UVB contribute to increased skin cancer risk.
- **The '+' sign:** The plus sign means 'more than'. For example, SPF50+ sunscreen must provide at least SPF60 in testing. This is because the same batch of sunscreen will test slightly differently in different laboratories with different methodology. By testing at SPF60, it removes any margin for error.

Level 1 questions have answers that can be determined directly from reading the article.

A new standard of sunscreen increases the maximum protection to SPF50+.
Circle: T / F / Can't say from the article

The level of UVB and UVA are both increased.
Circle: T / F / Can't say from the article

UVA does not increase the risk of cancer.
Circle: T / F / Can't say from the article

SPF50+ blocks out 96.7% of UVB.
Circle:　　T / F / Can't say from the article

If the UV index is below 3 then sunscreen should definitely be applied.
Circle:　　T / F / Can't say from the article

If the UV index is exactly 3 then sunscreen is needed.
Circle:　　T / F / Can't say from the article

A child needs 35mL every 2 hours.
Circle:　　T / F / Can't say from the article

Level 2 questions have answers that are not directly stated in the text but can be inferred.

SPF50+ filters out 1.3% more of the UVB radiation than SPF30+.
Circle:　　T / F / Can't say from the article

UVA only makes you look older but is not harmful.
Circle:　　T / F / Can't say from the article

When out in the sun for 3 hours an adult will need about 70mL sunscreen.
Circle:　　T / F / Can't say from the article

SPF50+ is really SPF60.
Circle:　　T / F / Can't say from the article

Manufacturers should not use terms like "4 hours water resistant" because application is needed every 2 hours.
Circle:　　T / F / Can't say from the article

Responses to the **Level 3 questions** need to be supported with written reasons. Students must write a paragraph about their choice.

The daily UV index should be written on the board at school next to the date.
Circle:　　T / F / Can't say from the article.
Then, give a written support for your answer.

Students and parents should not be told what to do. We do not live in a "nanny state" and it is their choice whether to wear sunscreen or not.
Circle:　　T / F / Can't say from the article.
Then, write a paragraph to support your answer.

PUZZLE SOLUTIONS

1. **Discovery**. The result had been <u>known</u> previously but Chika found it by himself. Well done Chika! Any natural number can be expressed as $N = 10x + y$ and we form $x + 5y$. Then,
$$7 \,|\, 10x + y$$
$$\Leftrightarrow 7 \,|\, 10x + y + 49y$$
$$\Leftrightarrow 7 \,|\, 10(x + 5y)$$
$$\Leftrightarrow 7 \,|\, x + 5y$$
It can be shown similarly that if 7 divides $x - 2y$ it also divides $N = 10x + y$, giving yet another test.

2. **Horses**. Strategy: eliminate every horse that is slower than at least three others and therefore slower than the three fastest. Start with five 5-horse races. The last two horses in each of these are slower than at least three others. After eliminating them, 15 horses remain. These can be grouped as 1st, 2nd and 3rd place-getters respectively from the first five races, and raced again in these groups. The winner in the first group must be the overall fastest horse. The last *two* horses in the 1st group are slower than at least three others and can be eliminated. The last *three* horses in the 2nd group are slower than at least three others as are the last *four* horses in the 3rd group. After eliminations, only five horses remain. They can be compared in one more race. Thus, nine races suffice.

3. **Rotation**. By letting the chord slide around the circle with point A fixed, we obtain a certain set of triangles. Exactly the same set of triangles is generated by keeping the chord in a fixed position and letting the point A move on the arc. In the latter case, the angle A is constant (Theorem: *angles in the same segment...*). Therefore, A must also be constant when the chord moves.

4. **Tricky triangle**. Look at it this way.
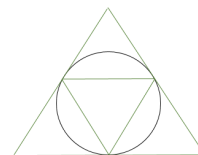
5. **To the moon and back.** Go backwards.

6. **Transformation.** Consider the past tenses.

7. **Invisible X.** The triangle is degenerate. $X = 1$, perhaps.

8. **In the land of the medians.** The ratios on XB and YC are the same—1:3. The margin of this page is too small to contain the proof. See the next issue.