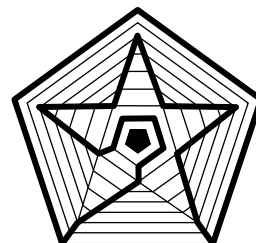


SHORT CIRCUIT

Newsletter of the Canberra Mathematical Association INC

VOLUME 11 NUMBER 2

MARCH 2020



NEWS AND COMMENT

Non-members and members of CMA alike benefit from the organisation's existence, through engagement with a professional network that supports and encourages individual educators, and by the professional development opportunities CMA arranges.

For members, there are further benefits, perhaps the strongest of which is the knowledge that they are contributing to the well-being of their profession. Membership renewals are now due and individual reminders will shortly be sent out.

This month there will be two professional development events. On Wednesday 11th, **Chris Wetherell** will deliver a workshop session on the use of the *area* concept in the curriculum, and on Saturday 21st, **Charlie Lovitt** will explore the Maths300 resource in an all-day TQI accredited program.

[The Chris Wetherell workshop is now fully subscribed and the names of further people wishing to register will be added to a supplementary list.]

In this edition of Short Circuit the Puzzles section has been expanded from its usual size and henceforth will include solutions where possible. Contributions to and comments on this section are always welcome.

The three miniMATHS workshops mentioned on page 2, result from a highly successful initiative taken by Bruce Ferrington. Two books of ideas for the primary sector have now been produced thanks to The ACT Government's Nature Play grant scheme.

Looking further into the future, we invite readers to save the following dates:

1. Thursday 11th June: Professional Conversation & Forum—*Online learning delivery in the ACT* (focus: secondary and college teachers)
2. Saturday 1st August: (All day, Mother Theresa Primary School, Harrison)—Peter Sullivan & Michelle Tregoning—*Creating a Mathsphere in your Classroom and School* (See page 6 for more.)

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Coming Events:

Maths300 workshop: Charlie Lovitt, on Saturday 21 March, 9:00 a.m.-4:00 p.m. ACU. (TQI accredited.)

miniMATHS workshops: 19 March, 26 March, 2 April.

CMA conference: 22 August 2020.

CMA AGM: 11 November, 2020.

Wednesday Workshop:

11 March: Chris Wetherell—Area (how to use it to teach the entire curriculum) at HBCITL 4:00-6:00 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**

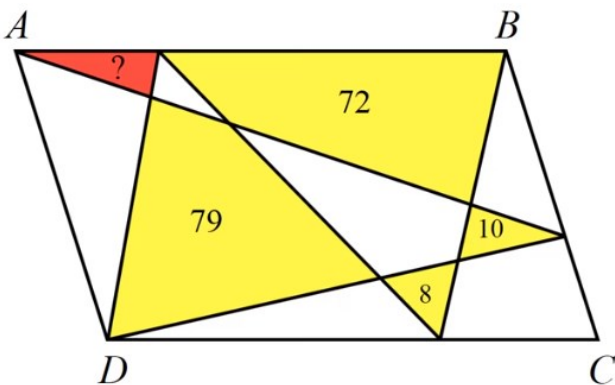
SHORT CIRCUIT

PUZZLES

These puzzles were assembled by Ed Staples. We have given solutions on the next page.

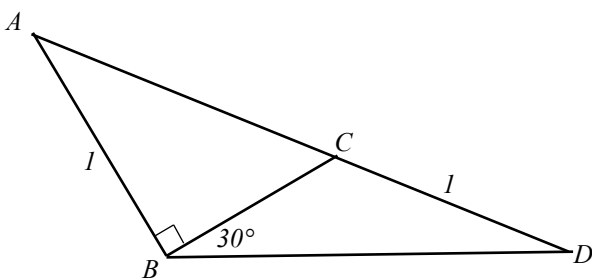
1 **HARD but ELEMENTARY** From China via Presh Talwalker at <https://youtu.be/OuJQaxZvLYs>

$ABCD$ is a parallelogram. In the diagram, the areas of the yellow regions are as shown. Find the area of the red triangle.



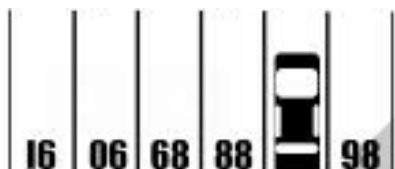
2 **HARDER** Source: Canadian Mathematics Olympiad.

In the figure below, AB and CD are of length 1, angle ABC is a right angle, and angle CBD measures 30 degrees. Find the length of AC .



3 **ANNOYING**

A car has backed into a parking spot. What is the number of the spot covered by the car?



4 **LOGICAL** From Martin Gardner.

Two mathematicians meet on the street and one says to the other, 'I bet you can't guess the ages of my three children (all integer ages).' The second mathematician says, 'I'll take your bet but only if you give me enough information to solve it.'

The first agrees and says, 'The product of my three children's ages is 36.'

'That's not enough information.'

'Right you are!' He looks around, spies an address on a building and says, 'The sum of my children's ages is the same as the address over there.'

Thinking a little bit, 'That still isn't enough information.'

'Right you are, again! My eldest child has red hair.'

After some thinking, the second mathematician won the bet. Could you?

AMAZING DISCOUNT

Sue Wilson found this nonsense in the Daily Telegraph:

A 63-hectare patch of land dubbed the 'mountain' in Beverly Hills hit the market last year with an eye-watering asking price of \$1 billion.

But now, after much confusion over who actually owns the property, it has now sold at auction for the remarkably paltry sum of \$100,000.

That's a whopping 10,000% discount.

miniMATHS

Bruce Ferrington is running workshops to explain and demonstrate the miniMATHS resources.

The dates and locations for the workshops are:
Thursday 19th March at Radford College, Bruce;
Thursday 26th March at Charles Weston School, Coombs;

Thursday 2nd April at Bonython Public School.

The workshops are free. They run from 4-6pm. Afternoon tea is provided. Register online at

<http://www.minimaths.com.au/Workshops/>

AAMT

The professional associations of mathematics teachers in each Australian state and territory are affiliated with the Australian Association of Mathematics Teachers.

Membership of AAMT is automatic on joining one of the local associations, such as CMA.

Benefits for AAMT members include resources accessible via the AAMT website. The journals *Australian Primary Mathematics Classroom* and *Australian Mathematics Education Journal* are published by AAMT and are distributed to members.

Download a complete PDF catalogue of resources sold by AAMT from www.aamt.edu.au/Webshop/Catalogue.

CMA members can order items from the AAMT catalogue at a discount.

AAMT has five [Connect with Maths](#) online communities teachers can join.

Also visit <http://topdrawer.aamt.edu.au> AAMT Top Drawer Teachers website.

SOLUTIONS

1

Cavalieri's principle assures us that the triangle with base AD whose vertex lies on BC , has area equal to half the area of the parallelogram. The same would be true of a triangle with base AB whose vertex lay on DC . But it is also true in this case where there are two triangle whose bases add to AB and whose vertices lie on DC .

If we now label the two uncoloured regions in the first triangle a and b , and the red region r , we can

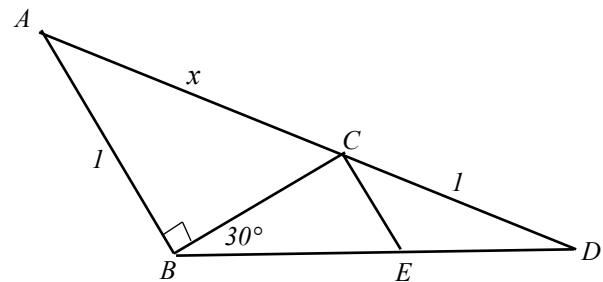
$$a + 79 + b + 10 = r + a + 72 + b + 8$$

express the half-area of the parallelogram in two ways, so that

From this, it is easy to see that the red region has area 9 units.

2

A construction will help. We found two that work. In this solution we use the following, in which CE has been drawn parallel to AB .



In triangle ABC , use Pythagoras to get an equation involving x and BC . Then, in triangle BCE , use the tangent ratio to get an equation involving BC and CE . Finally, obtain an equation involving CE and x from the similar triangles CED and ABD .

Combine these to obtain the quartic equation

$$x^4 + 2x^3 - 2x - 4 = 0.$$

This factorises to $(x + 2)(x^3 - 2) = 0$ and we see that the only positive solution is $x = 2^{1/3}$.

One might well ask what would happen if the 30° angle were to be replaced by any angle θ greater than 0 but less than or equal to 90° . Going through the same steps as before we reach the quartic

$$x^4 + 2x^3 - 2x - \operatorname{cosec}^2 \theta = 0$$

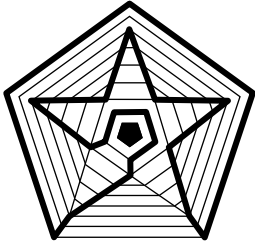
This equation can only have algebraic numbers for solutions if the constant term $\operatorname{cosec}^2 \theta$ is a rational number. This usually only happens when θ is a transcendental number, but there are exceptions: $\theta = 30^\circ$, 45° , 60° , 90° . When $\theta = 30^\circ$ or $\theta = 90^\circ$ the quartic is easy to solve, but not otherwise, and the case $\theta = 90^\circ$ is rather trivial. In this sense, 30° is special.

3

What would the numbers look like to a driver going forwards into the parking spot?

4

From the first clue, the children's ages could be 1 1 36, 1 2 18, 1 3 12, 1 4 9, 1 6 6, 2 2 9, 2 3 6, 3 3 4. It has to be either 1 6 6 or 2 2 9 to make the second clue inconclusive. Therefore, the answer is 2 2 9 so that an eldest child can exist.



**NEWSLETTER OF THE CANBERRA
MATHEMATICAL ASSOCIATION
INC**

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We're on the Web!
<http://www.canberramaths.org.au/>

THE 2020 CMA COMMITTEE

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Find us on Facebook

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.

Short Circuit is edited by Paul Turner.

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(IM²C) international mathematical modeling challenge

An opportunity for senior secondary students to work as part of a team to solve a genuine, real-world problem using mathematics.

10 March – 27 March 2020

Completely free to enter, and open to all Australian schools, the International Mathematical Modeling Challenge (IM²C) exists to support the real-world application of learning, build proficiency, encourage collaboration, and challenge students to use mathematics to make a real difference to the world around them.

Operating in teams, comprising up to four students from the same school, the IM²C challenges students around the world to work together to solve a common real-world problem by devising and applying an original mathematical model.

By mobilising students in teams, the IM²C replicates real-world conditions, requiring proficiency in mathematics alongside collaboration and contributions from different skill sets, perspectives and methods to achieve overall success.

Working together under the supervision of a team advisor (usually a teacher) for up to five consecutive days between 10 March and 27 March 2020, teams will unpack the given problem, hypothesise, test, and develop a working solution, before preparing and submitting a report on their solution to the Australian judging panel.

Two teams will be chosen to represent Australia in the International phase of the competition, with their solutions competing against others from countries around the world.

For further information and to register, please visit
www.immchallenge.org.au



The International Mathematical Modelling Challenge (IM²C) in Australia is organised and implemented by the Australian Council for Educational Research (ACER), and under the guidance of a national advisory group.



CREATING A
MATHSMOSPHERE
IN YOUR CLASSROOM AND SCHOOL



WITH PROFESSOR PETER SULLIVAN

SAVE THE DATE

SAT : AUG
1ST : 2020

Join us at Mother Teresa Primary School HARRISON for a day of professional learning and hands on workshops.

Participants will learn from two of Australia's leading Maths educators: Professor Peter Sullivan and Michelle Tregoning, as well as local ACT numeracy leaders.

Further information, including registration details, will be available via <https://www.moherteresa.act.edu.au/> in the coming weeks.