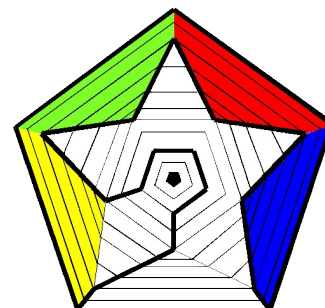


SHORT CIRCUIT

Canberra Mathematical Association Inc.

VOLUME 14 NUMBER 12 DECEMBER 2023



NEWS AND COMMENT

Although it is a frivolous expenditure of pixels to mention here that the season of assessment and reporting will soon be over and teachers will begin their summer break, the thought will be comforting nevertheless. May your educative powers be fully restored!

Following the recent Annual General Meeting, the Canberra Mathematical Association has a new council for 2024. The new members are Jenny Missen from St Francis Xavier College, and new education graduates Bernadette Matthew and Morgan Murray.

Long-time councillor Sue Wilson has left for a more coastal region. At the AGM, Sue was warmly thanked for her years of service to CMA and the council.

A full list of councillors is on page 4.

The CMA 2024 conference is set for March and plans for it are advancing. See page 3. Let us know if you would like to offer a workshop.

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MEMBERSHIP

Memberships run from 1 Jan to 31 Dec. each year. Membership forms may be downloaded from the CMA website:

<http://www.canberramaths.org.au>

The several benefits of Membership of CMA may be found on the website.

NEWSLETTER

The CMA newsletter, Short Circuit, is distributed monthly to everyone on our mailing list, free of charge and regardless of membership status.

That you are receiving Short Circuit does not imply that you are a current CMA member but we do encourage you to join.

Short Circuit welcomes all readers.

**CANBERRA
MATHEMATICAL
ASSOCIATION**

YEAR 12 MATHS MEDALS

Each year CMA makes available to schools and colleges Mathematics medals for the best student in Year 12 Mathematics.

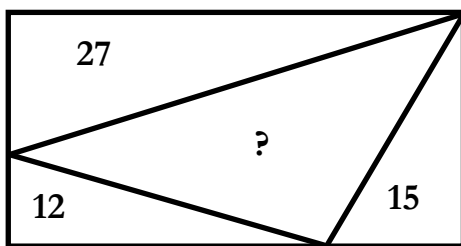
Please contact

Peter McIntyre (Kambah) on 0403 509 952 or Valerie Barker (Aranda) on 0410 151 554 to arrange collection.

PUZZLES

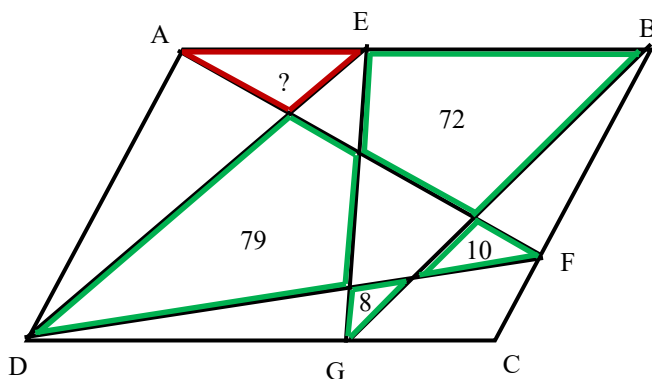
1. Dissected rectangle

The numbers in the triangles represent areas.



2. Dissected parallelogram

This one is harder. Hint: Consider three sets of triangles—the pair with bases making up BC with vertices on AD, the pair with bases forming DC with vertices on AB, and the one with base AD and vertex on BC, .



3. One over the radio

This puzzle came from an ABC radio broadcast. Two pirates*, at night, wish to divide a cache of approximately 300 gold coins equally between them but there is one coin left over. So, they wake up another pirate, thinking of a three-way split. Again,

there is a coin left over. In turn, they wake up a fourth, fifth and sixth pirate and in each case there is a coin left over. When a seventh pirate is brought in, an equal division is finally achieved.

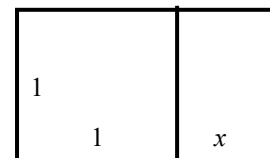
How many coins were there?

Further questions suggest themselves that were not posed on the radio program.

1. Is the solution you found the smallest number that has this divisibility property?
2. Is there a larger solution than the one you found?
3. Are there infinitely many numbers with the same divisibility property, and if so, how might you prove it?

*Real pirates are not known for their commitment to fairness or to mathematics.

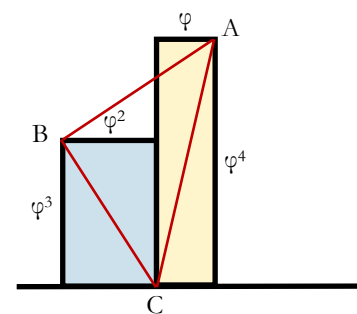
4. Golden ratio



In the diagram, a rectangle has been added as an extension to the unit square in such a way that the sides of the resulting large rectangle are in the same proportion as the smaller. That is, $(1+x)/1 = 1/x$.

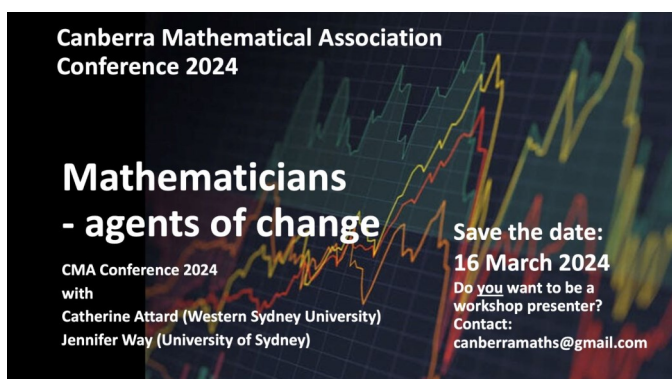
The number on the left of this equation is the *golden ratio*. It is usually represented by the Greek letter φ .

In the following diagram the dimensions of the rectangles are given as powers of φ .



What can be said about the shape of the triangle ABC?

CMA 2024



ICME-15

The [International Congress on Mathematical Education](#) is the largest international conference on mathematics education in the world. This quadrennial event is organised under the auspices of the International Commission on Mathematical Instruction and explores current global trends in mathematics education research and mathematics teaching practices at all levels.

The 15th International Congress on Mathematical Education (ICME-15) will take place 7-14 July 2024 at International Convention Centre in Sydney, Australia. ICME-15 promises to be an innovative congress that builds on the well-established ICME program, showcasing established and emerging thought leaders from around the world.

SOMETHING TO EXPLORE

The fraction $1/7$, expanded as a decimal, has a repeating part with period 6.

$$1/7 = 0.142857142857142857\dots$$

If we sum successive digits in pairs, we find

$$14 + 28 + 57 = 99$$

If we add successive digits in groups of three, we have

$$1428 + 5714 + 2857 = 9999$$

$$1428 + 5714 + 2857 = 9999$$

More explicably, perhaps, $7 \times 142857 = 999999$.

The fraction $1/13$ also has a period 6 decimal expansion with a similar pattern when digits are added in groups of 2, 3 or 4.

CMTQ RESULTS

The Canberra Maths Talent Quest results have been announced to the schools who submitted entries.

First and second prize entries, in three different categories and five year-groups, came from Canberra Grammar School, Holy Trinity Primary School, Radford College, and Melrose High School.

The topics students chose to investigate included, among other things, aspects of radar, rockets and space travel, population modelling, costing of consumables, and probabilities in sport and geophysics. One student imagined turning a large body of water into jelly!

Look out for the CMTQ in 2024.

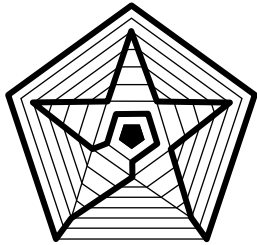
MATHS IN THE STREET

Nicolás Atanes Santos, a mathematics student, writes—

‘We are organizing and coordinating a Mathematics in the Street initiative for March 10, 2024.

‘The goal is to bring mathematics games to the streets and implement them in towns and cities across various locations simultaneously. This aims to promote mathematics, emphasize its significance, and celebrate the International Day of Mathematics, observed annually on March 14.’

CMA understands that Nicolás is looking to find people to run a street stand with a list of games and puzzles he has supplied. If you feel inspired to be involved, please let us know.



**NEWSLETTER OF THE CANBERRA
MATHEMATICAL ASSOCIATION INC. INC**

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Australia

E-mail: canberramaths@gmail.com

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

THE 2024 CMA COMMITTEE

President	Bruce Ferrington
Vice Presidents	Aruna Williams
Secretary	Valerie Barker
Treasurer	Jane Crawford
Membership Sec.	Paul Turner
Councillors	Peter McIntyre
	Theresa Shellshear
	Heather Wardrop
	Andrew Wardrop
	Yuka Saponaro
	Matthew Millikin
	Jo McKenzie
	Jenny Missen
	Morgan Murray
	Bernadette Matthew

Theresa Shellshear is CMA's COACTEA representative.

Bruce Ferrington is CMA's AAMT representative.

Joe Williams is the website manager.

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.

Radford College
Erindale College

Brindabella Christian College

University of NSW Canberra
Australian Catholic University

Melba Copland Secondary School
Marist College
ACT Education Directorate
St Francis Xavier College



Find us on Facebook

Short Circuit is edited by Paul Turner.

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CALCULATOR HELP

Peter McIntyre has produced a book, in several volumes, about using the Casio and Texas Instruments families of calculators. The many operations that can be performed on these calculators are explained, together with suggestions for classroom activities.

The author has made the documents available, free of charge, through the CMA [website](#). Go to the ‘resources’ tab and look under ‘calculator resources’.

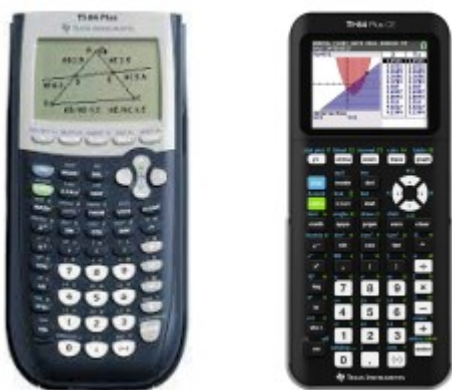
..The resource is introduced as:

Mathematics on a Graphics Calculator—A set of comprehensive materials in book form written by Peter McIntyre for the **TI-84** (84, 84CE) and **Casio 9860** (CG20/50) families of graphics calculators, which cover most models currently in use in schools other than the TI-nSpire/Casio ClassPad. The aim is to make life easier for teachers and students to use the calculator for Maths and appreciate its full power.

The materials range from mostly how to do various Maths operations on your calculator in a mathematical context to more-extensive notes. All are illustrated with examples and calculator screen shots. All topics have exercises and/or activities with full solutions.

Mathematics on a TI-84/CE

Written for both the older TI-84Plus and the newer TI-84CE. The book comes in four volumes and a Volume 1 Supplement, together with programs.



Volume 1: Basics contains the topics: *Graphics Calculators and Mathematics; Getting Started; Coordinate Ge-*

ometry; Inequalities and Linear Programming; Fitting Curves to Data 1 – Calculator Functions; Population Modelling 1 – Exponential Growth; Financial Mathematics 1 – Compound Interest; and Probability and Statistics 1 – Descriptive Statistics.

Volume 1 Supplement: Activities for Years 9 and 10 contains extra activities for *Coordinate Geometry* and *Probability and Statistics 1*.

Volume 2: Calculus contains topics directly relevant to Calculus and its applications, although *Functions and their Graphs* is of more general relevance and also contains details of how to capture screenshots from your calculator, crop them if desired and insert them into documents. The topics are: *Functions and their Graphs; Graph and Calculus Operations; Numerical Integration; Taylor Series; Differential Equations; Population Modelling 2 – Logistic and Epidemic Models; Multivariable Calculus; and Program Information.*

Program Information lists all the programs in the book, and gives information on copying and using the programs. Programs are provided in a zip file on the website.

Volume 3: Advanced contains more-advanced topics, relevant to students and teachers of Specialist Mathematics and Mathematics courses in first-year university: *Sequences and Series; Probability and Statistics 2 – Probability Distributions and Hypothesis Testing; Matrices and Vectors; Population Modelling 3 – Matrix Models; Fitting Curves to Data 2 ; Financial Mathematics 2 – TVM Calculations; Complex Numbers; and Programming.*

Volume 4: Mathematics Labs contains 28 Mathematics labs or projects suitable for Year 12 and beyond, together with a Lab Manual for teachers/instructors. 1

Mathematics on a Casio 9860/CG20/CG50

The Casio graphics-calculator models CG20AU and CG50AU are basically the same as the 9860 used in the book (except for higher-resolution screens). This is probably true of all Casio graphics calculators one level below the ClassPad. There may be minor differences in how the screen looks and

the menus but they all do the same calculations.



The book comes in three volumes and a Volume 1 Supplement, together with programs.

Volume 1: Basics contains the basic topics: *Graphics Calculators and Mathematics; Getting Started; Coordinate Geometry; Inequalities and Linear Programming; Fitting Curves to Data – Calculator Functions; Population Modelling 1 – Exponential Growth; Financial Mathematics 1 – Compound Interest; and Probability and Statistics 1 – Descriptive Statistics.*

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trices and Vectors; Population Modelling 3 – Matrix Models; Financial Mathematics 2 – TVM Calculations; and Complex Numbers.

Contact Happy to receive comments, corrections, suggestions, requests for help, etc. Send to

pdmcintyre@icloud.com

Peter McIntyre Canberra July 2023

IM²C 2024

Registrations for the International Mathematical Modeling Challenge 2024 are now open.

The IM2C committee sets a challenging real-world problem each year. Teams of up to 4 students have 5 consecutive days to interpret the requirements, gather data, create and implement mathematical models, test the solutions and produce a 20-page report. In Australia, the reports are judged by a qualified panel of teachers and mathematics education researchers, and the 2 best reports are then submitted to the international round of judging.

To further enhance students' experience of the power of mathematics to help better understand and solve real world problems, **IM2C Australia is excited to partner with university mathematical modelling research groups in 2024.** The winning team from most of the states/territories will have the opportunity to visit these [research groups](#) (either in person or virtually) to learn more about how researchers use mathematical modelling to solve real-world problems. The winning groups will get to spend 'a day in the life' of a university mathematical modelling researcher, visiting the grounds, labs and classes of the universities, including lunch on campus if students are attending on-site.

The IM2C 2024 will occur from 13 February – 26 March 2024.

For more information, visit the [IM2C website](#).



PUZZLE SOLUTIONS from [Vol 14 No 11](#)

1. Transitivity

Three dice A, B, C have had their faces re-numbered so that their spots are

A: 2, 2, 4, 4, 9, 9

B: 1, 1, 6, 6, 8, 8

C: 3, 3, 5, 5, 7, 7

Three players who we also call A, B and C corresponding to the die each holds, play in pairs. We claim that the probability that A beats B is $5/9$. Also, the probability that B beats C is $5/9$. How likely do you think it is that A beats C?

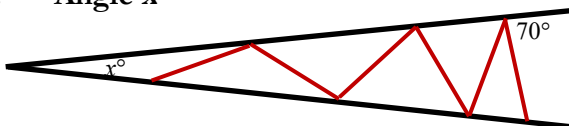
Transitivity fails. For each pair of players there are 9 distinct pairs of scores, equally likely. In four of these score pairs, A beats C. Check that the probabilities are as given for A plays B and B plays C, and that the probability of A beating C is $4/9$.

2. The cat factor

“It used to be told at St Edmondsbury,” said Father Peter on one occasion, “that many years ago they were so overrun with mice that the good abbot gave orders that all the cats from the country round should be obtained to exterminate the vermin. A record was kept, and at the end of the year it was found that every cat had killed an equal number of mice, and the total was 1,111,111 mice. How many cats do you suppose there were?”

The number 1,111,111 has prime factors 239×4649 . Either 239 cats caught 4649 mice each, or 4649 cats each caught 239 mice. Finding factors is hard!

3. Angle x



The red line segments are equal in length. Find angle x . Is there a pattern? If so, how far could it be extended?

The question neglected to mention that the left-most triangle is isosceles, as are the triangles bounded by the red line segments. With this information and considering the exterior angles we can deduce that the pairs of equal angles in the successive triangles from left to right are $x, 2x, 3x, \dots, 6x$. This makes $7x = 70^\circ$ and therefore $x = 10^\circ$.

After triangles with equal angles 70° then 80° we would reach a ‘degenerate’ 90° angled isosceles triangle and the process ends.