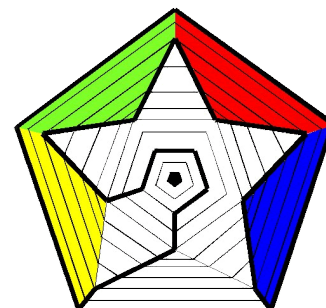


# SHORT CIRCUIT

Newsletter of the Canberra Mathematical Association INC

VOLUME 14 NUMBER 6 JUNE 2023



## NEWS AND COMMENT

In the April edition of Short Circuit (Vol. 24, No. 4), the editorial directed readers to some journal articles that said harsh things about NAPLAN.

In this edition we swing back with an article on the obverse side of the debate. Again, like the long article in the May edition, this one deserves patient attention.

Towards the end of the piece, the author asks, pertinently, *Can something be good in theory, but so bad in practice that it should be avoided altogether?*

Dare we suggest that the sharpest criticisms ought to be directed at the ways in which NAPLAN is used, or not used, in practice; but not so much at NAPLAN itself. Pointed remarks might best be aimed at institutions and individuals who, for reasons we can only speculate about, fail to use the data appropriately.

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Winter is coming! Stay warm.

## CMTQ 2023

Details are on the CMA [website](#).

## IM<sup>2</sup>C

International mathematical modelling challenge: [website](#).

## Coming Events:

## 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.

## SHORT CIRCUIT

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.

CMA welcomes all readers.

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## PUZZLES

### 1. Narayana's cows

The 14th century Indian mathematician Narayana Pandita described, as follows, how to generate the sequence of numbers that now carries his name.

Calculate the number of cows present each year, starting from one cow in the first year, where every cow has one baby cow each year starting in its fourth year of life.

It is not hard to see that the sequence starts with  $\{1, 1, 1, 2, 3, \dots\}$  but how big are the 10th, 17th and 30th Narayana numbers?

(Musician Tom Johnson talks about this sequence on [YouTube](#), and there are several performances of his musical version on that platform. He starts at year 4. Try [this](#).)

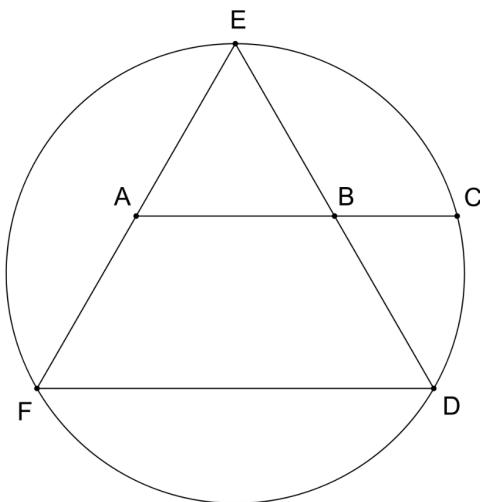
### 2. Odom's construction

George Phillips Odom Jr was an artist who became interested in geometry. Although confined to a mental hospital, he found some previously unknown constructions for the golden ratio, which he communicated to the geometer H. S. M. Coxeter.

Coxeter published one of them in the form of a puzzle in 1983:

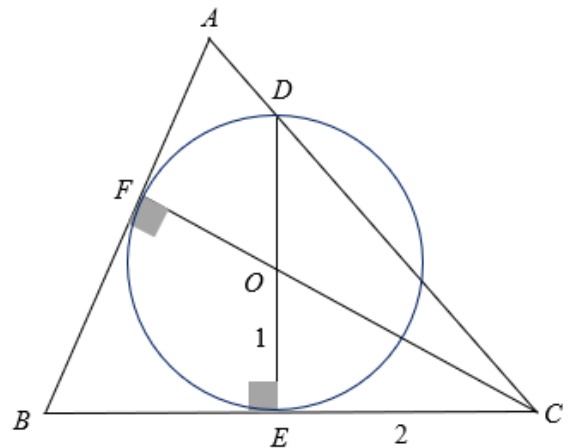
*Let  $A$  and  $B$  be midpoints of the sides  $EF$  and  $ED$  of an equilateral triangle  $DEF$ . Extend  $AB$  to meet the circumcircle (of  $DEF$ ) at  $C$ . Show that  $B$  divides  $AC$  according to the [golden section](#).*

That is, show that  $\frac{|AB|}{|BC|} = \frac{|AC|}{|AB|} = \phi$



### 3. More steps to phi

Find the area of triangle  $ABC$  given that  $CE = 2$  and  $OE = 1$ . (The circle centre is at  $O$ .)



## THE GREAT NAPLAN DEBATE

From Ross Turner

In November 2015, I was invited to take the negative side in a debate at the annual general meeting of the Mathematical Association of Victoria (the Victorian equivalent of the CMA). The debate topic was:

“That National Testing distracts teachers from the business of teaching their students mathematics”.

It seems this is still a topic of discussion and interest within and outside school communities. So, I present here a distillation of the arguments I made that evening.

The debate topic includes words and phrases that invite some definition and argument: national testing, business, distraction.

### NATIONAL TESTING

National testing means “the national administration of standardised tests and centrally set examinations”. National tests contain centrally set procedures for the preparation of their content, for administration and marking, and for the interpretation and use of their results.

NAPLAN was in full swing around Australia in November 2015, so the topic had special currency, but of course national testing is a much wider issue.

... A BUSINESS?

Is mathematics teaching a *business*? The debate topic implies so.

If teaching is a business, where are our profit and loss statements? What is our return on investment? Is our business healthy? What benchmarks do we use to monitor our business performance?

These are questions for education that cry out for relevant *data*.

A researcher friend of mine once worked out that if we paid kids \$10 an hour to go to school, as if it were a job like mowing a lawn, the total cost would be \$36 billion dollars a year. That foregone income is what *students* are investing in the business of education. What are they getting back for their investment? Is it an investment worth making, or would they be better off mowing lawns and buying themselves a Mercedes? How do we know?

To the extent that teaching is a business, we need to define what we will mean by success, and we need to *measure* whether we are achieving success.

To the extent that teaching is a business, the owners and stakeholders have a legitimate need to know about the health of the business and the extent to which it is meeting its objectives.

... OR NOT A BUSINESS?

But of course, many of the stakeholders in the outcomes of our education system do not think of teaching as a business.

To many of the *teachers* in this group, teaching is more a craft than a business. To those teachers, quality and value are often judgments made by connoisseurs. But even those teachers need data on the quality of their output.

To some other teachers who reject a business model, teaching is more like a science. For them, the scientific method might be applied, with objectives

clearly defined, strategies devised, tactics employed, results generated, scrutinised and evaluated, and improvements then designed for tomorrow.

*Students* typically do not adopt a business model of schooling; it's more like a game. They are used to games, with winners and losers, ladders and premierships, promotion and relegation between grades, and constant pressure to strive and aspire. We see game plans, hard training, difficult selection decisions. In that model, you cannot avoid serious feedback. It's there all the time.

Whatever way you care to characterise teaching, effective teaching is directed towards achieving or promoting learning outcomes; and good quality information about the success or otherwise of efforts in this regard is essential.

A DISTRACTION?

Our debate topic has another curious phrase: 'testing distracts teachers'. How much of a teacher distraction is testing? And how prone to distraction are teachers?

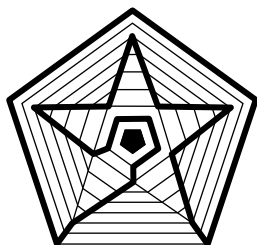
If testing is a distraction, is marking of students' work a distraction? Is preparation of classroom materials? Is reading an article about teaching? Is a school-agreed assessment program a distraction? What is *teaching* if assessment is a distraction?

A real distraction is a loudspeaker announcement repeated three times asking Mr Figgins to go to the front office because he has left his car lights **on**. Or when the Assistant Principal suddenly remembers there was supposed to be a fire drill that day, and the school is thrown into chaos for the rest of the morning.

Those are distractions. National testing is just part of the teaching process.

HOW DOES TESTING ACTUALLY HELP?

Returning to the first element of the debate topic, we must face the ultimate question: does national testing hinder, or does it help?



## NEWSLETTER OF THE CANBERRA MATHEMATICAL ASSOCIATION INC

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

## THE 2023 CMA COMMITTEE

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Joe Wilson is the website manager.

Short Circuit is edited by Paul Turner.

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## ABOUT THE CMA

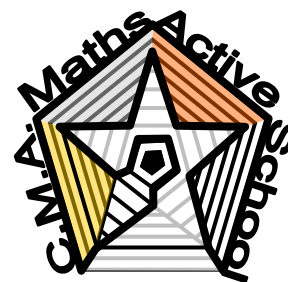
The Canberra Mathematical Association (Inc.) is the representative body of professional educators of mathematics in Canberra, Australia.

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.



Find us on Facebook

At this point I must provide a disclaimer: the organisation for which I work is in the business of assessment. For the last 15 years [now 23 years] I have made my living at the Australian Council for Educational Research managing ACER's leadership of one of the world's largest comparative surveys – the Program for International Student Assessment, or PISA. Before that I had a significant role at the body now known as the Victorian Curriculum and Assessment Authority. I was at its predecessor organisations – VCAB and the Board of Studies – at the time the VCE was overhauled, and when the Victorian forerunners to NAPLAN (known first as the LAP, then the AIM) were introduced.

Assessment is an essential part of the work of teachers; always has been and always will be. A healthy teacher, classroom, school, and education system will all use plenty of carefully crafted assessments, designed and implemented at a variety of different grain sizes depending on the purpose at hand.

The best teachers will engage their students in very fine-grained assessments of their levels of understanding in relation to specific teaching and learning objectives. This is critical information for optimising strategies for both teachers and students.

Summary assessment data at class-level and cohort-level within a school will exist to monitor relative performance of different class groups, and to track development over time.

National testing gives broader-brush comparative information that locates the performance of individuals, class groups, and school populations on a common scale, hence providing objective information about learning in relation to defined benchmarks.

International surveys can give useful comparative information about how countries are tracking relative to an external standard; and most importantly how learning outcomes might be changing over time.

National testing, therefore, forms an essential part

of a comprehensive monitoring strategy that is designed to improve learning outcomes and to inform the policy process that drives our schools and education systems.

An excellent example came past my desk just the other day. A recent analysis of Australia's national testing data showed that students who had previously been engaged in early learning programs attained significantly higher Year 3 NAPLAN scores. This provides empirical evidence in support of expanding federal government initiatives in the early childhood learning area. A great opportunity has been identified, at a point in the growth path of students where an educational intervention can have a measurable impact.

Consider where national testing fits in the European context. A 2009 report from the European Commission provides extensive information about how 30 European countries are using results of their national assessments. Some use national testing to inform decisions about certification and educational progression. Some are focussed on monitoring and evaluation of schools and education systems as a whole; and some use national assessment mainly for the purpose of assisting the learning of individual pupils.

It could not be clearer that national testing in those contexts is an absolutely central and critically important aspect of schooling. It has become a virtually universal educational practice over the last 20 years or so.

... AND IF NAPLAN DID NOT EXIST?

Where would Australian schools and school systems be without a National Testing Program?

Those who are opposed to national testing, or indeed any systematic standardised testing, might not be old enough to remember what happened before the various movements to institute external assessments. In the heady days of the seventies, when some of us were Marxist-Lentilists, George at Mugwump Tech used to give all his students an A because they were working class kids who were op-

pressed and the curriculum did not reflect their cultural experience.

Muriel at Barking Primary gave extra marks in maths to children who sat up straight and looked clean.

And Kelvin, at Missionary Alternative School of Astrology, didn't assess his students at all because who was he to judge? Was he, like, better than his students?

The most memorable maths report I saw as a teacher, at the beginning of the 'descriptive assessment' era, was a kind of three-word slogan: "A likeable lad."

Without an external measure, parents in Albert Park would have no objective information about how their children are progressing relative to students in Ararat, Ainslie, Adelaide, or Andamooka. Most parents want that information, and they have a right to receive it.

How does a teacher in Andamooka know what kinds of performances are achieved in other schools? How does a young teacher, in particular, get a sense of what to expect? Some external reference is essential to provide a basis for sound and comparable professional judgments.

Students similarly would have no objective measure of their relative progress in the priority areas of literacy and numeracy.

Schools would have lost a potentially useful suite of data that assists their quality monitoring efforts and their work on devising improvement strategies.

Governments and their school systems would have lost the only available data that can be used to monitor relativities among groups of students in whom great policy interest exists: girls compared to boys; indigenous compared to non indigenous students; students in urban schools compared to students in rural and remote locations; schools in one region, state or territory compared to those in another; and any changes to these relativities over time that may have been caused by the improvement strategies

adopted.

The problem faced by the affirmative side of this debate is that its proponents can mount a case only in relation to the apparent flaws and faults in a particular instance of national testing. They don't have a reasoned scientific argument about the *concept* of national testing; they are forced to ignore the many obvious benefits that can be derived from national testing; and can only cite evidence about supposed weaknesses in a specific example.

Can something be good in theory, but so bad in practice that it should be avoided altogether? Or is it more common that we accept some weaknesses of implementation in light of the overriding benefits, while striving to repair the weaknesses?

Some people think that religious principles are mostly good in theory, but somewhat let down by observed practices of organised religion.

Has this seen an end to religion? Not on your Nellie. It doesn't seem to matter how bad organisational practices become; religion continues to have its champions.

#### THE ANTI-NAPLAN CASE.

Those in the anti-NAPLAN camp use several arguments to push their case. Here are three such arguments.

1. Some schools and teachers spend inordinate amounts of time practising and preparing for NAPLAN.

It reminds me of an era when our senior secondary students were said to be spending inordinate amounts of time working on their VCE Investigative Projects, to produce the best possible report that would be deserving of the highest possible score. It is interesting that mathematics education people around the world know about the assessment innovations of the then new VCE mathematics study, and see them as watershed developments. It is important to distinguish good ideas from some aspects of the ways in which they are put into practice.

Two things can be said about *teaching to the test*: first, apart from knowing what to expect with test layout and the format of test questions, no measurable benefit is gained by practising NAPLAN; and second, the normal work of mathematics teachers will help students prepare for NAPLAN whether they think about it or not.

Teachers and schools choose to spend *a little* or *a lot* of time consciously preparing for National Tests. This is not a feature of national testing; it is a feature of the way some people choose to approach it.

2. A second major area of criticism of NAPLAN lies in *technical aspects* such as the breadth of error bands around the ability estimates of individuals and groups. This may sound like statistical hocus-pocus, but it is important, and all teachers know that assessment results must be interpreted in an appropriate way.

The lesson here once again should not be that NAPLAN is bad – that would lead us to a ‘baby and bathwater’ situation. The important consequence of the technical critiques that exist is that users of the data must be very clear about the limitations on interpretation of any assessment data at the different levels at which it is used.

And national testing provides very substantial benefits at the cohort level, where these technical issues largely disappear, benefits that are not available in any other way.

3. A third area of criticism of NAPLAN, perhaps the most significant and important criticism, and for which we see some blame-shifting, lies in evidence that students have been placed under intolerable pressure because of NAPLAN’s existence, and that this pressure is doing harm to individual children.

Once again, the problem here is not with national testing, rather it stems from the way in which NAPLAN is currently approached by some schools, teachers and also by some parents.

If NAPLAN were talked about as a normal and essential part of the range of standard assessment

activities employed in schools, and if it were clear to teachers, students, and parents just how NAPLAN data are used to improve educational outcomes and teaching and learning practice, perhaps some of the tension surrounding NAPLAN would dissipate.

## CONCLUSION

National Testing is not the problem. Far from being a distraction to teachers, national testing provides essential information at a variety of levels that can be used in many ways to improve learning.

## PUZZLE SOLUTIONS from [Vol 14 No 5](#)

### Invisible game

Anna, Bo and Chris like to play a certain game where there is always exactly one loser. At the start of each game the players reveal how much money they have. When the game finishes, the loser has to pay each of the others the amounts those players started the game with. After playing just three games, each player has lost exactly once. They find, curiously, that they have ended up with \$24 each.

What were the three amounts they began with?

Suppose the three players begin with dollar amounts  $a$ ,  $b$ ,  $c$  and the players with those amounts lose in that alphabetical order. At the beginning of the second round, the players have amounts

$$a - b - c, 2b, 2c$$

respectively and at the end of the game they have

$$2(a - b - c), 3b - a - c, 4c.$$

Then, at the end of the third game, the amounts are

$$4(a - b - c), 6b - 2a - 2c, 7c - b - a.$$

Each of these amounts is equal to 24. So, we can form a system of three independent equations with the solution

$$a = 39, b = 21, c = 12$$