

Newsletter No. 41

March 2005

Attending conferences always gives one a lift. Not only do you get that 'up with the play' feeling but the shared experience, professional and social discussion, and the opportunity to hear leaders in your field, all go to rebuild enthusiasm that may have waned a little. Besides local conferences or in-service days most years there are national or international ones that you can attend. The MERGA conferences for Australasian maths educators have been an annual event for 28 years and are certainly worth attending (see below). It's a long way off until the next ICOTS conference but if you're interested in presenting a paper it might pay you to get your thinking caps on soon. ICOTS 7 will be held in the city of Salvadore, Brazil between July 2-7, 2006. ICOTS conferences are held every four years in different parts of the world and their main purpose is to give statistics educators and professionals the opportunity to exchange information and research in their field. You may remember that the last time it was held in New Zealand (ICOTS 3) was at the University of Otago in 1990. The conferences cover all educational groups from primary to tertiary and teachers will find the material discussed at their level very accessible.

In the meantime we have our own NZAMT conference coming up later this year. Keep reading these newsletters to stay informed about conferences on mathematics education as well as other issues in the area.

Few teachers now are so conceited as to know that they have a great deal to learn, and that their methods need revising and improving but the majority are seeking for improved methods of doing more of what they are already doing a great deal too much of.

Mary Boole (1832-1916)

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What's new on nzmaths

The latest addition to the nzmaths site is Te Reo Pāngarau; a Māori language dictionary of mathematics terms. You can find it from the Rauemi Reo section of the site or at this link <u>http://www.nzmaths.co.nz/maori/Dictionary/</u>. As well as translating English to Māori and vice versa, the dictionary includes glossary entries for most words, and audio links which will "speak" the words and some key sentences in Māori for those of us who need a little help with pronunciation.

We have also made a couple of additions to the Numeracy Projects section of the site:

- The Numeracy Books for 2005 are now available and you can download them as pdfs from http://www.nzmaths.co.nz/numeracy/2005numPDFs/pdfs.htm.
- For people with 2004 versions of the books there are some changes which you should be aware of; these changes and pages which you can download and stick into your books to update them are available at http://www.nzmaths.co.nz/numeracy/2004numPDFs/pdf updates.htm

Work is progressing on the new and improved Numeracy database, and we are on track to have it completed by mid May.

Diary Dates

The annual conference of the Mathematics Education Research Group of Australasia, MERGA, is scheduled for July 7-19, 2005 in Melbourne. The conference will provide opportunities for mathematics teachers, educators and curriculum developers to contribute and listen to research presentations and be actively involved in workshops, symposia and special interest groups developed around the conference theme of Building Connections: theory, research and practice. The website address is of monstrous length so we suggest you put your search engine onto MERGA 28 for further details.

27-30 September. 2005: NZAMT Conference to be held at Christ's College, Christchurch. For more details check the website <u>www.nzamt9.org.nz/</u>.

Bill and $\boldsymbol{\pi}$

When I wrote that heading I remembered my old friend Bill Pye. He was a mathematician who rose to be Head of the Melbourne Teachers' College and for quite a while we were good mates. I haven't seen him so much since I came to New Zealand though. At the height of our collaboration we produced a series of text books that were way ahead of their time (that's one way of saying that they were brilliant but didn't sell). If you want a bit of fun go and look up Creating Calculus, or Probing Probability or Aggregating Algebra and see what Gan and Tug got up to.

Anyway, that wasn't what I meant to write. How did you go with the two reading assignments last month? You remember the two articles; one by Bill Bryson and the other about π .

It's certainly amazing that of the 5 papers that Einstein had published in 1905, three rocked the world. One was on the photo-electric effect (that got him a Nobel Prize), another was on Brownian motion (not sure what that is exactly but it changed a lot of things in Physics) and the third introduced General Relativity. It's clear that they didn't impress the Swiss Patent Office as they wouldn't promote him from Patent Clerk Third Class to Patent Clerk Second Class. Well it's just hard to please some people.

As far as π goes though, Archimedes found a pretty good approximation to it by enclosing a circle between two regular polygons. It's something you can do yourself. Put a regular hexagon inside a circle and another one outside and you can see that the area of the circle lies between the areas of the two hexagons. Then if you do the same thing with two regular 7-sided figures you'll see that you get two better approximations. So keep on going with 8- and 9-sided figures. The further you go the better approximation you'll get.

As far as we know, William Jones (1675-1749) was the first person to use the symbol π . But the man who popularised it was none other than the great mathematical overachiever, Euler (pronounced Oiler). You can find more than you ever need to know about Euler by doing a search on the web.

If you want a feel for π to 1.24 trillion places turn to page 246 of the book by Posamentier and Lehmann. You'll still be looking at digits when you get to page 273! (But there are still a few empty lines on that page.) And the interesting thing about the 360th digit is not that it is 6 but that the 359th is 3 and the 361st is 0.

You really should have a copy of both books in your school library.

Mary Boole (1832 - 1916)

We had a quote by Mary Boole above and it might be appropriate to pass on a little bit about her.

The first decade of Mary's life was spent in France where her father was recovering from an illness. One result was that Mary's first language was francais, pas anglais, although she also spoke the latter. Her main inspiration, in terms of education received, was continental. She and her siblings' teacher was M. Deplace who used a method popular in France at the time. The method, possibly based on Rousseau's teachings, had children led to new concepts by asking them a series of questions and then telling to write answers as soon as the question was asked. The teacher would then have them analyse the questions and answers. In this way they would come to a better understanding than would have been the case had he told them directly.

Mary's father was worried about her brilliance. Worried, that is, that the world would not accept a woman of her intelligence, higher education at that time being a prerogative of the men. Any mathematics she learnt after leaving France she did on her own. She used her father's books and he laid no restrictions on her meeting the many brilliant friends of his like Herschel and Charles Babbage.

She was 18 when she first met the mathematician George Boole and he became her tutor. They were married five years later. He continued to teach her maths (she attended his otherwise male-only lectures) and she encouraged him with writing his book 'Laws of thought'. After his untimely death she taught maths - to future governesses in the women's part of the college and held the official title of 'Librarian'. However, she was forced to quit this job after she wrote the book, 'The Message of Psychic Science for Nurses and Mothers'.

Many things occupied her time; teaching children maths was one, where she followed Deplace's method with her own additions. In particular, she believed that children should be given mathematical objects to play with and thus develop, at their own pace, ideas of order and pattern. For instance, she invented curve-stitching cards. She was fascinated by the psychology of learning maths - she felt maths was absorbed not just through the mind but through the entire body. Mary was not at all in favour of competitiveness in the early stages of learning. In her own words, "The stimulus of competition, when applied at an early age to real thought processes, is injurious both to nerve-power and to scientific insight and only dead mathematics can be taught where the attitude of competition prevails: living mathematics must always be a communal possession."

Communication was another of her strong points. She organised popular 'Sunday Night Conversations' where she discussed with students philosophy, animal rights, logic, evolution, psychology, etc. She felt these sessions were to amuse and not to teach. She put many of her thoughts onto paper, though most of her books were only published posthumously. Some were considered controversial at the time (the Victorian era), others were considered too unscientific with her emphasis on psychology. Perhaps if she'd used a male pseudonym like others of her time she may have been more widely read.

Maths Curriculum Project Reference Group Meeting 11/2/05

As you are should be aware, the whole of the school curriculum is being reviewed at the moment and a revised curriculum should come into being in 2007. So Maths is in there with the other essential learning areas looking at what needs to be done to bring the Burgundy Bible of 1992 up to date. There are three writing groups meeting under the leadership of Vince Wright to do this and the Reference Group is the body that is keeping an eye on the progress of Vince's teams. On the Reference Group are primary and secondary teachers, college of education people, and academics. In addition, from time to time the Reference Group is supplemented by additional experts. At the February meeting, we were fortunate to have Jane Watson (Tasmania, an acknowledged international expert in Statistics), and Richard Lehrer (Nashville, Tennessee, whose international expertise is in Measurement and Geometry).

Now there are two things that have to be said at the start. The first is that in Maths anyway, there will be few changes in the new curriculum. There seems to be a general feeling that the 1992 authors were pretty much on the ball. The second thing is that, despite what has just been said, when you see the new curriculum you may wonder how on earth this is like the current statement. The reason for this apparent contradiction is that the stock take task force recommended that all of the curricula needed to be repackaged in the following ways: (i) there is to be a single document to cover all learning areas; (ii) all learning areas will be presented in the same format; and (iii) the number of the achievement objectives is to be reduced. So it's as a result of (iii) that the new curriculum will apparently look nothing like the old one. In order for you to see past this new format and to give more precision to the necessarily sparser new achievement objectives, each learning area will have supplementary documents published that we will refer to here as 'second tier material'. This second tier will amplify the achievement objectives in much the same way that the suggested learning experiences amplify the current achievement objectives.

As we have said in a previous newsletter (October 2004), the current drafts of the new Maths curriculum have just three strands: Number and Algebra; Geometry and Measurement; and Statistics. The reason for the first of these is that research since the last curriculum was published has shown how intimately Number and Algebra are intertwined. It seems to be very difficult indeed to be able to learn Algebra unless you have a good understanding and feeling for Number. It was felt that combining the two current strands would help to emphasise this connection. Statistics (including Probability) is a fair slice of the mathematical pie and Measurement is relatively small. Even though not all of Measurement is Geometrical, much is and it was still felt valuable to combine these two parts of the curriculum. In doing so, the new curriculum ends up with three reasonably homogeneous and related sections of work.

Under Vince's guidance, the teams have been working on each of Levels 1 to 6 of the three new strands, as well as the whole of Levels 6 to 8. At the last meeting of the Reference Group, all day was spent on explaining where the teams had reached with their deliberations, listening to the feedback of the two experts, and studying and discussing the story to date.

It is probably too early to talk about the draft material at the achievement objectives level though this will be available in early 2006. However, it may be useful here to say that it is currently planned that the strands from Levels 1 to 6 will be divided in the following ways: Number and Algebra – Number Strategies, Number Knowledge, Equations and Expressions, Patterns and Relationships; Geometry and Measurement – Measurement, Shape and Space, Position and Orientation, Transformation; Statistics – Statistical Investigation, Statistical Literacy, Probability. The material for Levels 6 to 8 is being finalised early next month.

If you would like to have some input into the development of the new curriculum, you can contact this web site (derek@nzmaths.co.nz or gill@nzmaths.co.nz) or wait until the

official consultation period which should be early next year. In the meantime, we hope to keep you as up to date with progress as we can through this newsletter.

Mind Reading

We take it by now that you have all looked at the mind reading web site <u>www.albinoblacksheep.com/flash/mind.php</u> and wondered how on earth it works. Well, we have two solutions to that and neither of them came from New Zealand. One is from Zach Jankowski, about whom we know nothing, and the other is from Jackie Gardners 6-th graders from Worcester, Massachusetts.

Zach's solution says:

It comes down to something simple, really, and it's the number 9. When you take any two digit number (10-99), add the two together, and subtract that sum from your original number you will ALWAYS have one thing in common: the number will be divisible by 9.

For example, random number. 62, 6+2 = 8, 62-8 = 54, 54/9 = 6. A whole number. Try it with any number 10-99, the number you end up with can always be divided by 9 and you'll have a whole number.

Now, if you'll go to <u>www.albinoblacksheep.com/flash/mind.php</u> you'll notice that the same symbol is repeated more than once, but in particular, all the numbers divisible by 9 (18, 27, 36, 45, 54, 63, 72, and 81) all have the same symbol. So whatever number you pick when you follow the procedure you'll get a number divisible by 9 and always have the same symbol.

You also might be asking, "then how do I get a different symbol each time?" If you refresh your screen you'll notice that every time it regenerates new symbols for all the numbers, so every time you refresh or click the Try again! button, it generates a new symbol for all the numbers (but all the numbers divisible by 9 will still have the same symbol as each other even though the symbol changes).

Jackie says almost the same thing:

I have three 6th graders, Uday, Tom and Sam, that have solved the mind reading site. They realised that if you add the digits then subtract, you would only get certain values for the answer (multiples of 9 up to 81). These values are always the same symbol. Hence, the magic crystal ball always shows the symbol that is the multiple of 9. (They checked and every time the game begins these numbers always get the same symbol.)

She also told us a little about herself and her school:

I have been using your site for 2 years now. I love the problems that are presented. I am a 7th grade math teacher (our school has team teaching). Bancroft is an independent day school, K-12. Our middle school has 175 students, about 600 total population. Worcester is an industrial city in the middle of Massachusetts. We are having an unbelievably snowy winter (which the students love as they get days off). The three 6th graders were in my room for a club when I decided to show them your challenge. They were pretty quick to solve the mystery - I was quite surprised. The three boys are studying fractions, decimals and percentages in class. They will cover area/perimeter and the Pythagorean Theorem towards the end of the year.

Have you got all of that under control? Then now have a go at <u>http://digicc.com/fido/</u>. On the other hand, if you have found a mind reading site or anything else that is a little different, we'd be glad to know about it so that we can tell others.

Solution to February's problem

Last month's problem was based around the well known 'year' problem. The digits of this year are 2, 0, 0, and 5. What numbers can you make using just those digits? Of course, you can use any of the four arithmetic operations along with square roots and any standard operation you can think of. You can even use the digits in 2- or more digit combinations. For instance you can get 40 from 200/5.

Moving on from here we set you the following challenge. Using the digits 2, 0, 0, 5 *in that order* and any of the operations $+, -, \times, \div, \sqrt{}$, indices, and factorials, with brackets and concatenation also allowed, how close can you get to the value of π ?

For example, $(20 + 0) \div 5 = 4$ which is a start but a poor one. Somewhat better is $\sqrt{(20 + 0 - 5)} = 3.87 (2 \text{ d.p.})$ which is approximately 23.3% in error. Can we get any closer? Well, $\sqrt{\sqrt{(200 - 5!)}} = 2.99$ (% error 4.8) and closer still, $\sqrt{(\sqrt{200 - 5})} = 3.02$ (% error 3.9)

As usual we offered a book voucher to the person who provided an answer closest to π under the given conditions. Now the only person who sent in an entry was Derek Smith of Lower Hutt. He actually gave the four 'attempts' that are listed below.

In the process he used some pretty clever mathematical foot work. For instance, in two of his 'attempts' he used the Integer value function, Int. This keeps only the integer value of a number. It removes the decimal part of the real number as follows Int(5.64) = 5 and Int(5.34) = 5. Elsewhere he used the determinant of a matrix, the exponential function e^x , and the inverse tan function \tan^{-1} . Is that cheating? Surely not.

Naturally he gets the prize for any of them.

Attempt 1:

 $(Int\sqrt{(Int\sqrt{(Int\sqrt{(Int\sqrt{(20! +0))})})}x\sqrt{\sqrt{\sqrt{\sqrt{5}}}} = 3.154743595}$ (% error 0.419)

Attempt 2:

 $(Int\sqrt{(Int\sqrt{(Int\sqrt{(Int\sqrt{(20! +0))})})}x\sqrt{\sqrt{\sqrt{(Int\sqrt{5})}}} = 3.132821347 \ (\% \ error \ 0.279)$

Attempt 3:

If det A is the determinant of the matrix $A = \begin{bmatrix} 2 & 0 \\ 0 & 5 \end{bmatrix}$, then $\sqrt{\det A} = 3.16227766$ (% error 0.658)

Attempt 4:

 $_{e}$ tan⁻¹($\sqrt{\sqrt{\sqrt{\sqrt{20}}}}$ + 0)x $\sqrt{\sqrt{\sqrt{(e5)}}}$ = 3.141304808 (% error 0.00916)

March's Problem

While Jenny was in the shop she exchanged a one dollar coin for six other coins. On the way home she lost one of them down the back seat of the car. What is the probability that the lost coin was a 10 cent piece?

We will give a book voucher to one of the correct entries. Please send your solutions to <u>derek@nzmaths.co.nz</u> and remember to include a postal address so we can send the voucher if you are the winner.