Newsletter No. 55
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Recently I decided to read Francis' Galton's Art of Travel (1872) again. I obtained it from the local library and was surprised to find it had already been read five times in the past year! Galton was one of the fathers of statistics and a very able arithmetician, navigator and surveyor. He also, at one time, lost some of his popularity by writing on the politically incorrect subject of eugenics but we won't go down that particular path now. You are recommended to read Art of Travel if you plan to embark on a long hazardous journey into darker parts of the globe, if there are such places today. It contains everything you need to know about, for example, how to break in an ox, how to make a tent frame from local materials and how to light a fire in a thunderstorm without matches. There is a comprehensive section on navigation that would interest many. A chapter on the 'management of savages' would be particularly useful to teachers. There are more details in our Booke Review below.

Knowledge is like the bow, ability like the target but it is wisdom which directs the arrow to the target.

## Yuan Mei (18 ${ }^{\text {th }}$ century Chinese)

55 is the tenth triangular number. The triangular numbers are $1,3,6,10,15, \ldots$ named because those numbers of dots can be arranged in triangular arrays with the same number of dots along each side. 55 is also a Fibonacci number. The Fibonacci numbers are $1,1,2,3,5,8,13,21,34, \ldots$ and they're related to growth patterns (see John Stillwell's article on Fibonacci numbers in our August 2003 issue). There are only four triangular Fibonacci numbers ( $1,3,21,55$ ). 55 is also the fifth square pyramidal number. Square pyramidal numbers are the successive sums of square numbers; 1, 5, $14,30,55,91, \ldots$ Cannonballs were often stacked in square pyramids and how many were in a stack was given by the appropriate pyramidal number.

In addition to all that number stuff, Bob Beamon's incredible long jump of 8.90 m at the Mexico Olympics increased the world record by 55 cm . It's also true that Louisa May Alcott, Elizabeth Barrett Browning, Julius Caesar, Christopher Columbus, Frederick Nietzche and Henry VIII all died aged 55.

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## What's new on nzmaths.co.nz

- We have now added an interface to the Māori versions of the learning objects.
- There are 3 new units of work related to the learning objects available under 'Operating with Number'.
- Several new links to other sites have been added in the Links section.


## Diary Dates

## 27 July

The Australian Mathematics Competition
http://www.westpac.co.nz/

## 14-18th August

2006 Maths Week
http://ww.mathsweek.org.nz

## 26-29 September

Australian Mathematical Society Annual Conference
http://www.austms.org.au/People/Conf/

## Booke Review <br> The Art of Travel (1872) by Francis Galton

For mathematical readers the main points of interest in the book are Dalton's methods of calculating distances travelled on a trek, whether by camel, horse or human feet, and other items related to navigation and surveying. There is his 'theory of loads and distances' encapsulated in the formula, $\mathrm{Bd}^{2}=\mathrm{b}(\mathrm{d}-\mathrm{D})^{2}$, where b is the burden which would just suffice to prevent the animal from moving a step, d the distance it could travel daily if unloaded, $B$ some burden less than $b$ and $D$ the distance it could travel when carrying $B$.

The book also contains many useful tables such as Easy Determination of Travel based on stride length, Chords to Radius 1000 apparently useful in measuring distances to inaccessible places, Specific Floating Powers for a range of different woods which would be useful to boat-builders and one giving the relative thermal insulation powers of
materials such as twisted silk, beaver's fur, eider down and taffety (sic). Another table shows the relative amounts of alkali in the ash of various materials such as pinewood or beanstalks which you need to know when making soap. There are tables of weight allowances as supplied by the British Navy (Admiralty Order 1824), Dr. Rae's allowance in Arctic America and Mr. Austin's in Western Australia. It would also be useful to know, and Galton doesn't fail us, the declination of the sun at various months of the year.

In addition to the above there is a delightful chapter on signalling describing Colomb and Bolton's system of flashing lights which was the predecessor of Morse Code. In fact there is everything you need to know for living (and dying) in this book. Many, such as how to load a flintlock rifle, how to silver a mirror, how to make glue, glaze pottery, fortify a camp, follow a track at night, intoxicate fish, build a cart and caulk a boat are of paramount importance to us all. This book leaves the Whole Earth Catalogue for dead, you shouldn't be without it.

## Compendium II

Last year a compendium of research findings related to the Numeracy Development Project (NDP) was produced and circulated to schools. The process is being repeated again this year. Much of the research in the latest compendium follows on the heels of similar research in the previous one and it is interesting to compare the results from each publication.

Before you say that you don't read research because it's always too hard and difficult to read, think again. To help, here are three easy steps into this compendium.

Step 1: Read the Foreword. This gives you an overview of the compendium papers. So you can get an idea from this of what is actually in the book without having to wade through pages of methodology, literature review, references, and the like. This Foreword is meant to be in plain English and should be a quick read. From this you should be able to see which papers you think might be worth reading. Highlight them as you go through so that you don't forget which ones could be useful to you.

Step 2: Read the Abstracts and Conclusions. Now you have decided which articles could be worth reading, go to them and in turn look at their Abstract and their Conclusion or Discussion sections. That may be enough in that you might get sufficient information from these sections to tell you what is going on, or for whatever reason to tell you that you don't want to read any further. But if that whets your appetite for more then go to Step 3.

Step 3: Read the Article. You should probably be prepared at the start to read a paper at least twice. In the first read through you'll get a good feeling of what the article is about and how helpful or informative it will be for you. The second read will cement the ideas and let you feel that you have got on top of what the author has tried to do and how well they have succeeded.

Here are some comments on the Compendium itself. First, the papers are divided into three sections: student achievement, professional practice, and sustainability. The student achievement section is based both on the data provided by individual teachers to the nzmaths site and by questions produced especially for this research volume. Generally the teachers' data shows that there is good progress being made by students in the Project. There are still differences between various groups but it is shown that these differences are less than appear in studies not related to the NDP.

One paper in this first section is different in style to the others and that is the one by Jenny Young-Loveridge where she looks at what children think that mathematics is all about. This is an easy read that gives a valuable insight into children's thoughts on the topic.

There are three articles in the section on professional practice that I'd like to mention. These are the ones on modelling books by Jo Higgins, on the reliability of teachers' assessment of their students by Gill Thomas and Andrew Tagg, and on pāngarau by Tony Trinick. The first of these suggests that using a book in conjunction with manipulatives aids students' learning. The second shows that teachers' assessment of their children via NumPA and GloSS is generally reliable, which is just as well as this is where much of the data for the papers of the first section comes from. And the third shows that the success of two kura is linked to a desire to revitalise Māori language, knowledge, and culture as well as a positive relationship between all the professionals in the schools

The sustainability section is about how best the numeracy work can be continued once the initial phase is over. Leadership within the schools seems to be important here with the involvement of the principal being critical.

By the way, if you are not associated with a school you won't automatically have access to this year's compendium of research findings. If you would like a copy, then email Malcolm Hyland at the Ministry of Education (malcolm.hyland@minedu.govt.nz).

## Curriculum II

It would seem that good things come in twos. The second two with the second coming is the national curriculum. This is the Burgundy Bible and supporting documents (I take a narrow view of these things) revitalised. In 1992 the country got its first maths curriculum from the beginning to the end of school. After 14 years there is a desire to bring the curriculum up to date. On the maths (and every other) side it will appear quite different. This is largely because of layout. The draft proposed curriculum has all the covering material as well as the achievement objectives for all the learning areas, in the one book. Each level has the AOs of each subject on one fold out page. As a result the maths achievement objectives may look quite condensed. However, there is meant to be little change. Actually the thing that may be most instructive is what is currently known
as the 'second tier' material. This will give examples of learning situations and will help to fill out and explain the achievement objectives.

The new curriculum will be available in school in July for comment. Make sure that you have your say by returning your thoughts by November. The time period allows for teachers, schools, teacher associations, and relevant groups to get together and go through the document in a thorough manner. Don't miss this opportunity.

After the consultation period more work will be undertaken on the curriculum and it is hoped to be in use in 2008 (or 2009 at the latest).

## Solution to June's problem

Last month's problem took an ordinary pack of 52 cards that and separated it into two unequal portions A and B . If a card was drawn at random from A , the odds were two-to-one against it being red. If however a red card had been transferred from portion B to portion A, then the odds would have been two-to-one against a randomly drawn card from $B$ being black. So the question was: how was the pack
 originally divided?

One way to do this is by algebra. Suppose there are $m$ red cards in portion A, then since the odds are two-to-one against a randomly chosen card from A being red there are $2 m$ black cards in A.

Since there are 26 red and 26 black cards in a standard pack there must be $26-m$ red and 26-2m black cards in portion B. Now, we are told a red card is transferred from B to A. This leaves $25-m$ reds in B with the $26-2 m$ blacks. We are also told that the odds are two-to-one against a randomly chosen card from B being black, so,
from which,

$$
\begin{aligned}
25-m & =2(26-2 m), \\
m & =9
\end{aligned}
$$

We were asked how the pack was originally divided. Portion A had 9 reds and 18 blacks, 27 cards altogether and portion $B$ had 25 cards of which 17 were red and 8 were black.

Another solution is by way of a spreadsheet where you can fairly quickly consider all possible cases. This is the old Proof by Exhaustion method, so-called not because it will exhaust you or your reader but rather because it exhausts all of the valid cases.

On the other hand you might try a bit of guess and improve. You could do that, as Maureen Sheldon did like this.

Pile A has 2:1 odds of a randomly drawn card being "not red". So there is a $2 / 3$ chance of a black card being drawn and $1 / 3$ for red. So I looked at splitting the 52 cards into two unequal portions, with Pile A being a multiple of 3 .

Using a guess and check strategy I tried $\mathrm{A}=24, \mathrm{~B}=28$.
If $A=24$, then 8 red and 16 black. Since there are 26 of each colour $B$ has 18 red and 10 black. Removing a red leaves 17:10 "not black". This does not fit the 2:1 "not black" criteria.

I will get less black in Pile B if I put more cards in Pile A. Try A=27, B=25. If $A=27$, then 9 red and 18 black. $B$ has 17 red and 8 black. Removing a red leaves 16:8 "not black".

So we give this month's prize to Maureen Sheldon.

## This Month's Problem

Last issue we included for the first time a problem on probability so while we're in the mood here's another:

Old McDonald had 100 sheep, 100 angora (white) goats. The fences on his farm were in poor repair and the animals were thoroughly mixed. One evening Old McDonald decided he'd put a sheep in the shed for butchering next day. Old McDonald's nephew Ralph was visiting from the city and decided to help his uncle out and do the job for him. Not knowing the difference between sheep and goats he grabbed the first animal he saw and shoved it in the shed. Not knowing that his nephew had been so helpful Old McDonald went out later, caught a sheep and put it in the shed, completely oblivious to the fact that there was an animal in there already. Next morning Old McDonald asked Ralph to get the animal from the shed. Ralph went to the shed and again grabbed the first animal he saw to take to his uncle. Fortunately it was what his uncle wanted, a sheep.

If you're of a pastoral bent you might like to work out the probability that the animal left in the shed is a sheep.

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

Note that your entries may not be acknowledged till the middle of the month.

## Solution to May's Junior Problem

Last month we looked at boxes containing white and black marbles. In fact we had three boxes and every box contained precisely two marbles. And we should have known what was in each box because someone had labelled them BB, BW, and WW. But the labeller has mislabelled every box.


To find out what really was in each box you were allowed to take one marble at a time from each box without looking at the other marble. What is the smallest number of marbles you need to look at before you know the contents of each box?

The clearest explanation came from Michael Catterall of HIBS. He proved that you only needed to take one marble provided it was taken from the right box.

The least you need to take is one, as long as you take it from the one labelled BW because if the marble drawn from the BW one is black then the other marble will also be black so the one labelled WW will have to have a black marble and a white marble in it because it cannot be WW and it can't be BB. So the last one (labelled BB ) will have to be WW because that is the only pair left.

But if the one picked from the box labelled BW is white it then must also have another white marble in it. So the box with BB on it must be BW, so the WW labelled one has to be BB.

Perhaps the easiest way to see this problem is to write underneath each of the labels, what the correct label might be. So we'd have something like this:

| Label | BB | BW | WW |
| :--- | :--- | :--- | :--- |
| Actual contents | BW or WW | BB or WW | BB or BW |

If we draw a $B$ from the BW box, then it has to be BB. So WW can't be BB and it has to be BW. But then BB has to be BB.

All this makes me wonder if we could get a similar problem with three marbles. Say the marbles were Red, White and Blue. We would then have boxes labelled, BBB, BBW, BWW, and WWW. If all of the labels were wrong how many marbles would have to be looked at before you could tell which box was which? I don't think that there is a nice answer to this. Can anyone help me out here?

## This Month's Junior Problem

This section contains a monthly problem competition for students up to Year 8. What's more the usual $\$ 20$ book voucher is available for the winner. Please send your solutions to derek@nzmaths.co.nz and remember to include a postal address so we can send you the voucher if you are the winner.

Let's try some more logic. Alice, Beryl and Clair all play ball games.
(i) If Alice plays netball, Beryl plays golf.
(ii) If Alice plays hockey, Clair plays golf.
(iii) If Beryl does not play hockey, Clair plays netball.

For the $\$ 20$ book voucher, who does what?
Note that your entries may not be acknowledged till the middle of the month.

