Newsletter No. 80 **February 2009**

It's unbelievable how quickly the summer recess disappears. Maybe it's because we are so busy enjoying ourselves and enjoyment can be so fleeting. Welcome back to the nzmaths website and our newsletter. If you're interested, 2009 has one square and two prime divisors.

There's been a lot of discussion in the U.S. recently about the teaching of maths, or as many parents perceive it, the lack of teaching. Judging from a number of newspaper headlines the common denominator, if you'll excuse the word play, is that parents believe it is fundamental for children to rote learn their multiplication tables. That is, if they are to succeed at mathematics. My old Dad once told me he had to learn them up to 20 by 20. When I was at primary school it was up to 12 by 12. What is it these days, I wonder? Do pupils have to learn them at all? Or is it sufficient they can obtain an answer on a calculator? What do you think about it anyway? Flick us an email and tell us your views.

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And now for the news! This month is the last newsletter that will appear in the old format and style. There will be no March newsletter as from now on there will only be six newsletters a year. These will consist of one in terms one and four and two in terms two and three. The details are still being finalised but from the next edition you can expect more emphasis on primary mathematics, some regular problem solving and a page that can be sent home for parents. Watch this space!

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As this is our 80th issue we've collected up a few bits and pieces about the number 80 for you:

A **semiperfect number** is a natural number *n* that is equal to the sum of all or some of its proper divisors. Adding up some of its divisors (e.g., 1, 4, 5, 10, 20 and 40) gives 80, hence 80 is a semiperfect number. The first few semiperfect numbers are; 6, 12, 18, 20, 24, 28, 30, 36, 40, ….

A **Harshad** number is a number divisible by the sum of its digits. 80 is a Hashad number, as are 10, 12, 18, 20, 21, 24, 27, 30, 36, ….

In 1932, American jockey Levi Burlingame rode his last race aged 80. George Burns was the oldest person to win an Oscar when he was 80 in 1976 for *The Sunshine Boys*.

The following loosed this mortal coil aged 80: Johann Bernoulli, Pope Paul VI, The Buddha (of food-poisoning), Wyatt Earp, Alfred Hitchcock, Golda Meir, William Wordsworth.

INDEX

What's new on nzmaths.co.nz

Keep an eye on the nzmaths site in the second half of this month. We have spent the last six months rebuilding the site and the new site will be launched in the middle of the month. As well as new branding there is a new Assessment section, and a redeveloped Planning Assistant that allows you to collect resources to create teaching plans with units, problem solving activities and NDP activities.

How Big Is One?

One of the advantages of getting old is that grandchildren seem to have miraculously appeared. I won't write any of the clichés that you might expect but they can be great fun. At the end of last year, grandma and I were shown the work of my oldest grandson. While she spent ages pouring over his English book with its long and perceptive essays (I have noted not to tell him anything about my personal life that I wouldn't want to see on TV), I went straight to his Maths book. Of course it was all brilliant, it goes without saying that he is a genius and the world is lucky to have him, but it was a work sheet on fractions that caught my eye and disturbed me.

Before I get around to the details, let me say that numbers by themselves are strange animals in that they don't have meaning unless they are in context. Which would you rather have 1 or 100? Or 1 or 1? Or 5 or 1/5?

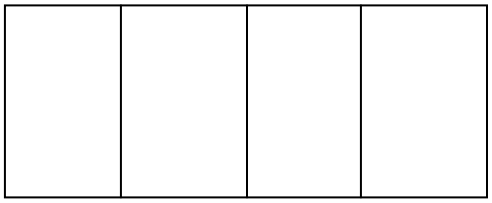
Suppose I offered you the choice of $1 US or 100c NZ. Which would you choose? At current exchange rates, the former is preferable. But if you are in Timaru and about to put money into a parking meter you'd probably go for the latter.

On the other hand, would you prefer 1 litre of petrol or 1 gallon of petrol? In absolute terms the gallon would get you further but where can you buy a gallon of petrol in Napier?

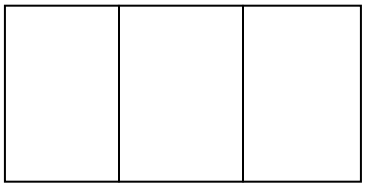
Then there's 5 and a 1/5. The number line again suggests that you should prefer 5 but if the choice is between $5 and 1/5 of your uncle's estate of $100,000, then you would change your mind.

So then we get to the work sheet. Which is bigger 1/4 or 1/3? We can all do that. It's clear what answer was expected. But I had read the worksheet through from the start. And this is something like the lead up to the question.

Shade 1/4 of the diagram.



Fine. The next question asked students to shade in 1/3 of the diagram below. (I haven't changed the comparative sizes of the two rectangles.)



It was only then that the children were asked to decide on the relative sizes of 1/4 and 1/3. How many got 1/4 and 1/3 as being equal I wonder.

So numbers by themselves mean very little. Fractions are numbers so that applies to them too. You have to have the unit the same to be able to compare fractions, or any other numbers too I guess.

Booke Review

The Last Recreations by Martin Gardner

It may seem strange to review this book under the heading of **Booke Review** which usually describes those of historical importance to mathematics. Martin Gardner is most well known for the Mathematical Diversions column he wrote each month for over thirty years in the Scientific American magazine. These were reproduced later in book form with corrections, expansions and updates to the originals. The articles began with a piece on hexaflexagons in December 1956 and concluded with one on minimal Steiner trees in May 1986. The Last Recreations is the fifteenth and final collection from the magazine and covers the last seven years before his retirement (he was sharing the column for some of this time). We reviewed the first book in our April 2007 newsletter. The reason we include Gardner's writings in our Booke Review column is because they are probably the most significant books to popularise mathematics in the 20th century. The two we have included are taken to represent all fifteen titles. For the complete list of these see Afterthoughts below.

This last in the sequence covers the usual diverse range of topics. In 'The Wonders of a Planiverse', Gardner describes A.K. Dewdney's remarkable explorations in Flatland - the land of two dimensions. 'Taxicab Geometry' explores the bizarre properties of a surprisingly simple

form of non-Euclidean geometry. Then there's the topology of knots, the symmetry creations of Scott Kim, checker recreations, the power of the pigeonhole principle, lots of new games and puzzles, problems to die for and …. the list goes on. In other words, this book follows the pattern of the earlier ones. It's accessible, full of surprises and interesting applications and a copy should be in every school library in the country - along with all the other fourteen titles in the series.

nrich Again

If you have a few bright sparks in your class or you are looking for some interesting problems for everyone, you could do worse than look up http://nrich.maths.org a site run under the aegis of the University of Cambridge. If you haven't logged in there before you'll see that the Home Page states:

The NRICH Project aims to enrich the mathematical experiences of all learners. To support this aim, members of the NRICH team work in a wide range of capacities, including providing professional development for teachers wishing to embed rich mathematical tasks into everyday classroom practice. More information on many of our other activities can be found here .

I suggest that you follow the here and see where it leads you. In the meantime I'll do a little leading myself. I clicked on 'For Students' and found seven more buttons that seemed to be interesting. These included this month's publication, mathematics to play and sign up for our newsletter.

'This month's problem' led me to several problems one of which was about the Zios and the Zepts. Apparently Zios have 3 legs and Zepts have 7. An explorer counted 52 legs. How many Zios and Zepts did he see? I'll let you get your class to worry about that.

But apart from problems there were answers by students to be found as well as articles and games. There are some nice coloured dominoes that you can play with.

From clicking 'Mathematics to play' I got to a number of games for a range of student levels. Some were clearly not for primary students but Tug of War certainly was. It's a simple game involving two dice and a number line. Low Go looked interesting. I would guess that there was a strategy there that I ought to be able to find.

You can also 'sign up for our newsletter' and join the student or teacher list to keep you up to date with nrich material or talk to other members.

Accessing nrich could be a very fruitful thing to do. There are a whole host of things to be tried. And if you find the January 2009 edition to be limiting don't worry – you can go back for material as far as November 1996!

Some Thoughts on History

You have to feel sorry for John Harrison who made a clock in 1715. Now you might not think that making a clock at the start of the 18th Century was no big deal. But there was an extremely important question to be asked and an accurate clock, more accurate than any that had so far been built, was needed. That was John's quest.

So what was the problem? Well international trade had become very big business by about this time and there were fortunes to be won and lost. The problem was that too many were being lost. Too many ships were running aground simply because they didn't know exactly where they were.

Now finding latitude was a long solved problem. Provided you had some clear sky you could take a position by celestial bodies. But an accurate time piece was necessary to discover exactly how far round the Earth you were in a vessel at sea. Of course the problem had been solved on land (see http://www-history.mcs.st-and.ac.uk/HistTopics/Longitude1.html) but most ships need sea to make any significant progressions.

The problem that Harrison had to contend with was more than producing an accurate clock that would remain accurate at sea with a rolling ship and changes in temperature. He also had to contend with a prize committee half of whom wanted to solve the problem themselves and hence win fame and fortune.

So did he perfect his clock and did he live to win his prize or did someone else beat him to it or was he cheated out of it? For all the gory details see 'English attack on the longitude problem' at http://www-history.mcs.st-and.ac.uk/HistTopics/Longitude2.html. And there are a whole lot of other very interesting mathematical or mathematically related stories on that Mactutor web site. It's worth a look.

This Month's Endeavour

These Endeavours are not meant to be solved by analytic methods. Setting up equations is not usually appropriate. Using an algorithm or spreadsheet is often more fruitful, although systematic trial and error can be successful especially when a process is susceptible to efficient shortcuts.

This month's endeavour is one favoured by many teachers as a piece of recreational mathematics at this time of the year. The idea is to express the natural numbers from 1 upwards, as many as you are able, using the digits 2, 0, 0, 9 in that order and the operations +, −, ×, ÷, with brackets ( ), factorial !, square root √, indices and concatenation (putting some of the numbers together, as in 20, 92 and 902).

Here's a start for you. I got up to 30 without too much trouble, how far can you get?
It might help you to know that 0! = 1.

$2^0 + 0 \times 9 = 1$
$2 + 0 + 0 \times 9 = 2$
$20 \times 0 + \sqrt{9} = 3$

Afterthoughts

Here is the complete list of titles in Martin Gardner's series of books based on his Scientific American articles with their publisher and year of first publication. Since they were so immensely popular they have been taken up by a number of different publishers and in some cases had their titles changed. The pattern being an American publication first (usually hardback) followed by a British hardback, then paperback versions on both sides of the Atlantic. For example, the most accessible version of the first book is in paperback and published by Penguin Books titled *Mathematical Puzzles and Diversions*. I have stuck to the original titles below, i.e. the ones under which they were first published.

1. Hexaflexagons and Other Mathematical Diversions (Simon and Schuster 1959)
2. The Second Scientific American Book of Mathematical Puzzles and Diversions (S&S 1961)
3. New Mathematical Diversions (S&S 1966)
4. The Unexpected Hanging and Other Mathematical Diversions (S&S 1969)
5. Martin Gardner's Sixth Book of Mathematical Diversions from Scientific American[1] (Freeman 1971)
6. Mathematical Carnival (Knopf 1975)
7. Mathematical Magic Show (Knopf 1977)
8. Mathematical Circus (Knopf 1979)
9. Wheels, Life, and Other Mathematical Amusements (Freeman 1983)
10. The Magic Numbers of Dr. Matrix[2] (Prometheus 1985)
11. Knotted Doughnuts and Other Mathematical Entertainers (Freeman 1986)
12. Time Travel and Other Mathematical Bewilderments (Freeman 1987)
13. Penrose Tiles to Trapdoor Ciphers (Freeman 1989)
14. Fractal Music, Hypercards, and more Mathematical Recreations from Scientific American (Freeman 1991)
15. The Last Recreations: Hydras, Eggs, and Other Mathematical Mystifications (Copernicus 1997).

[1] I have not been able to ascertain why this is called *The Sixth Book of Mathematical Diversions*. Gardner also refers to it being his sixth compilation in the Introduction to the book. It's possible that his books were not published in the order in which he compiled them. Another explanation is based on a letter received from the author a few years back in which he listed his publications to date. The sixth book in the series is given as *The Sixth Book of Mathematical Games.* However, the first in the series is called *Mathematics, Magic and Mystery* (Dover 1956). Although it was written in the style of the others, it was published before Gardner began his Scientific American articles.

[2] Although this book is a compilation from Gardner's *Mathematical Games* columns in Scientific American, it is specific to those articles recounting his visits and interviews with the fictional numerologist Dr. Irving Joshua Matrix. They are essentially tongue-in-cheek, as perhaps behoves an internationally known skeptic writer.

Martin Gardner has also written other books on recreational mathematics including; *Aha! Insight* (Freeman 1978), *Aha! Gotcha* (Freeman 1982), *Science Fiction Puzzles* (Potter 1981),

Puzzles From Other Worlds (Random House 1984) and a number for children including *Perplexing Puzzles and Tantalising Teasers* (S&S 1969) and *More Perplexing Puzzles and Tantalising Teasers* (S&S 1977). He has also written on science, literary criticism and philosophy and has published two novels. Among the works he has edited are Boris Kordemsky's *The Moscow Puzzles* (Charles Scribner 1972) and the *Mathematical Puzzles of Sam Loyd* (Dover 1959).

For a more comprehensive list of titles and a biography check Martin Gardner out at http://en.wikipedia.org/wiki/Martin_Gardner