 anyone around to see it? Possibly primitive peoples in other parts of the globe may have thought it had connections to gods. Maybe it even gave rise to the god-concept - now there's a thought.

It is certainly true that the Babylonians systematically plotted the positions of the moon, any comets and the known planets. It might be interesting to ask your students how they think that was done. No telescopes were available, just sticks for utilizing the effects of parallax and protractors to determine angular measures. The Babylonians were clever enough to note that some planets first moved across the sky in one direction, then reversed before reversing again and continuing in the original direction. They had some interesting explanations for these phenomena. Later the Greeks devised even more complicated explanations to predict more accurate positional fixes. There must have been a lot of satisfaction in pointing your stick up into the sky where you expected a planet to be and then finding it was! One Greek, Aristarchus (287-212 BCE), even believed that the planets rotated about the sun. It was a radical thought at the time and not believed. It took over 1700 years for the idea to gain general acceptance.

Since the study of early astronomy involved lots of measurement and large numbers there are many opportunities to tie it in with the current curriculum. Why not give it a thought.

Nature's great book is written in mathematical symbols

## Galileo

It may interest you to know that $1318820881^{2}=1739288516161616161$, then again, it may not!

More about 61? Well, '61' was a baseball movie released in 2002 and directed by Billy Crystal. 'Highway 61 Revisited' was one of Bob Dylan's better known albums. The West German Chancellor Willy Brandt was forced to resign at age 61, as was American President Richard Nixon over the Watergate scandal. On a sombre note Friedrich Bessel, Beau Brummell, Samuel Taylor Coleridge, Paul Ehrlich, Thomas Gainsborough, Ernest Hemingway, Benito Mussolini and Walter Scott all died aged 61. By the way, can you tell us which of those was a mathematician? (see Afterthoughts below)
$I \mathcal{N D} \mathcal{D E} X$
$\mathcal{N}$ umeracy Conference
Folding Sheets and Other Problems revisited
Maths Reach
Booke Review
Solution to Marcf's problem
Problem of the month
Solution to $\mathcal{N}$ ovember's I unior Problem
This Montf's Iunior Problem
$\mathcal{N u m e r a c y}$ Conference
The National Numeracy Facilitators Conference was held in Auckland this month. The number of participants has grown steadily over the years as the Numeracy Project has progressed through primary school and into secondary school. The keynote speakers at this year's conference were Megan Franke from UCLA, Max Stephens from the Australian Catholic University, Melbourne, and Gill Thomas from Maths Technology, Dunedin. Over the next few months we hope to be able to put an outline description of what they said into the newsletter along with some interesting pieces from some of the workshop presenters. Unfortunately we haven't got any of those organised as yet. However, we are collecting the Powerpoint presentations of the keynote speakers on our web site (they are not all yet available but we will upload them over the next few weeks). You can find them at:
http://www.nzmaths.co.nz/Numeracy/References/keynotes07.aspx

Folding Sheets and Other Problems revisited
In the last newsletter I listed three problems. Thanks to various readers I got answers to two of them. The one I thought was impossible may have a solution. Here are some thoughts.

Bernard Liddington said
Crossing the road - you and the lady were on opposite sides of the road. (Which is of course true.)

Re your problem of folding the fitted sheet: they were designed by the devil - wonderful in their usefulness but when you come to fold it then you see it's evilness! It's like a Rubik's cube - it can be done but no one has printed a simple guide yet!

But on the other hand, John Kramer (One Tree Point School) said

My wife (Linda) folds them perfectly, here are the instructions. I have photos, but they are on her father's camera. Try and follow the instructions and let me know if you need the pictures. I tried it tonight and it works sort of. Happy folding.

Fold sheet in half with the short corners together.
Put the corners together so all 4 corner seams are in your left hand With your right hand grab the bottom of the elastic below your left hand and bring up to the top in a triangle.
Move left hand over so part in left hand joins over with what was held in right hand.
Fold down in quarters from top to bottom.
I'd like to hear from any successful folders. For various reasons I haven't had a chance to check Linda's solution out.

## MathsReacf

From their own publicity, "the NZIMA launched a new initiative, called "MathsReach", this week. New Zealand's Prime Minister, the Rt Hon. Helen Clark, officiated at the launch at Onehunga High School (24 Pleasant Street, Onehunga) on Friday 23rd February.
"The aim of MathsReach is to show school students and teachers what lies beyond the school curriculum in mathematics and statistics, in terms of professional careers, research activity, hot topics, and interesting and important applications. This will be achieved through a variety of media (video clips, web links and special articles), with a focus on people and what they do.
"This resource will be available on a website and as a DVD - free of charge to schools. The launch on 23rd February marks the first step in its development. Resource material on the web and the DVD will be supplemented and updated over time.
"See http://www.mathsreach.org/ for the initial release."
So who is NZIMA and why did they dream up MathsReach? NZIMA stands for the New Zealand Institute of Mathematics and its Applications. This is the only Mathematical Centre of Research Excellence (CoRE) and it's located at Auckland University. Other CoREs in other disciplines are to be found in various universities. They are places that aim to stimulate research in particular areas through running conferences, attracting world leaders in research, helping young researchers, and so on. This latest venture of NZIMA aims to make mathematics accessible to a wider audience by giving some idea of what research mathematicians do and why it is useful as well as giving examples of jobs that mathematically trained students undertake. You might like to $\log$ in and check it out.

The Schoolmaster's Assistant: Being a Compendium of Arithmetick - T. Dilworth This book was first published in the U.S.A. in 1773 and ran to various editions in Britain. It was a popular text for over 50 years. It was divided into four parts the contents of which seem somewhat randomly chosen today:

Part I: Whole numbers with the four rules, various shortcuts to arithmetic, simple and compound interest, discounts, exchange rates, weights and measures, permutations.
Part II: Vulgar fractions.
Part III: Decimal fractions - square roots, cube roots, other roots, annuities, pensions, leases and estates, volumes as they relate to timber.
Part IV: 104 miscellaneous problems including many puzzles.
For example:
A man driving his geese to market was met by another who said, "Good morrow master with your 100 geese." Says he, "I have not 100 but if I had half as many as I have now and two geese and a half, beside the number I already have, I should have 100. How many had he? [Answer below]

The approach to the subjects in the book was by question and answer:
For example:
Q. What is notation?
A. It is the art of expressing numbers by certain characters or figures.

The book would be a good buy now at the original publisher's price!

Solution to Marcfis problem
The problem was essentially to find the sides of Duz's right angle triangle where one side is 12 and the other three sides don't have a factor in common.

It is thought that Pythagoras' already knew what Euclid later wrote, in a geometrical sort of way, that a general expression for Pythagorean numbers can be expressed as; $\mathrm{m}^{2}+\mathrm{n}^{2}, 2 \mathrm{mn}, \mathrm{m}^{2}-\mathrm{n}^{2}$. You might like to demonstrate this.

Since 12 is the length of Duz's shortest leg and it is even, we can equate $2 \mathrm{ab}=12$ or $\mathrm{ab}=$ 6 . Both a and b are whole numbers so the pairing could be 1,6 or 2,3 . If the former then Duz's three legs would be 12,35 and 37 . If the latter then $12,5,13$, however this last is not possible since 12 is the length of Duz's smallest leg. Hence Duz's longer two legs are 35 and 37.

I'm glad to say that we had several attempts at this but no one used this method. Excel spreadsheets were in vogue but I thought that the nicest correct solution used Pythagoras' Theorem. So, the winner is, ... Marnie Fornusek of Rotorua. Here is the solution.

The triangle is a right angled triangle with its shortest side $=12$. Using Pythagoras theorem $12^{2}+x^{2}=y^{2}$ where y is the hypotenuse. Therefore $12^{2}=y^{2}-x^{2}$ and $144=(y$ $x)(y+x)$ using difference of squares. This means that $y-x$ and $y+x$ are factors of 144 . The pairs of factors that multiply to give 144 are: $1 \& 144,2 \& 72,3 \& 48,4 \& 36,6 \&$ $24,8 \& 18,9 \& 16,12$ and 12.
By solving the simultaneous equations $y+x=$ factor a and $y-x=$ factor b we can see that $2 y=$ sum of the factor pair. As all sides are whole numbers all factor pairs that have an odd sum can be discarded. $12 \& 12$ is also discarded as this would mean side x has length of 0 .

This leaves $2 \& 72,4 \& 36,6 \& 24,8 \& 18$
For $2 \& 722 y=74$ so $y=37$ and $x=35$
For $4 \& 362 y=40$ so $y=20$ and $x=16$
For $6 \& 242 y=30$ so $y=15$ and $x=9$
For $8 \& 182 y=26$ so $y=13$ and $x=5$
The pairs $y=20$ and $x=16$ and $y=15$ and $x=9$ cannot be the sides of Duz because they have common factors. The pair $y=13$ and $x=5$ is not applicable because Duz's shortest side is 12 not 5 . Therefore Duz must have sides of 12,35 and 37 as these numbers have no common factors
'This Mont反's Problem

Magic squares have fascinated people for thousands of years. The simplest is a three-by-three square containing the whole numbers from 1 to 9 , with each row, column and and main diagonal summing to 15 .


It is not essential that the numbers in the magic square be consecutive, just that the rows, columns and main diagonals sum to the same value that is called the magic constant. We investigated magic squares in two earlier issues of the newsletter (issues 27, September 2003 and 37, September 2004). If you go back and look at these you'll have absolutely no difficulties with this little problem.


In this magic square two numbers have been filled. In addition we know that the magic constant is 123 .

Can you fill in the remaining numbers of the magic square?
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.

Solution to $\mathcal{F e}$ bruary's I unior Problem
Last month's problem was this. Now a 2-digit number is something like 54 which uses two digits; a 3-digit number is something like 547 which uses three digits; a 4-digit number is something like 5470 which uses four digits, and so on.

How many 4-digit numbers are there which use only odd digits (i.e., the numbers $1,3,5$, 7 and 9)?

Can you explain how you got that number?
I got the best solution from Kieran Liddington whose Dad, he noted, is having the conversation about the sheet with you. So I need to thank the Liddington's for their strong contribution to this month's newsletter. Kieran says

I have redone this problem and I now think the answer is $\mathbf{6 2 5}$. I found out that there can be five different digits in each space. So $5 \times 5 \times 5 \times 5=625$.

Essentially Kieran is saying that the five digits $1,3,5,7,9$ can be put in the units place, the tens place, the hundreds place and the thousands place. As there are five possibilities for each of these places, there are 625 possible numbers

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

Following up from last month, how many 5 -digit numbers are there that only use even numbers but in such a way that no digit occurs more than once? And I need to know why your answer is correct!

Afterthoughts

Friedrich Bessel (1784-1846) was the mathematician although perhaps he was better known as an astronomer. He introduced to mathematics the functions which bear his name.

The answer to the geese driving problem in Booke Review above is 65 .

