

Newsletter No. 45
Being a teacher of mathematics can be a frustrating business. Originally we may have studied the subject for the appeal of its clarity and precision, or maybe we just did well in it at school. Either way, we probably like nothing better than inviting others to share the pleasure it brings. Teaching for us should be a joyful occupation. Sad to say, it often isn't. Many of the students in our classes are there by compulsion. They may not particularly like mathematics, meaning that our efforts are often spent on motivation rather than exploration. We've all heard the phrase, "What use is this going to be when I leave school?" Indeed it is almost a cliché. Perhaps it is replaced these days by, "Are we going to be tested on this?" or "Is this part of the syllabus?". Either way such remarks can be soul destroying to a teacher exploring a whim or following a side issue. Students would much rather concentrate their efforts on perceived needs - those aspects of the subject they need to understand before proceeding to the next level or for completing a task.

A problem-solving approach to the teaching of mathematics may not only inspire us teachers to explore new ways of introducing mathematical topics but may also help motivate our students - solving two problems for the price of one, as it were. Better get perusing the nzmaths website!

We have an article this week on the Numeracy Project by Lynn Tozer. Lynn is in the Advisory Service at the Dunedin College of Education and spends a great deal of her time as the Otago Regional Coordinator for the Numeracy Project. As someone very much at the forefront of the Numeracy Project we welcome her article this month.

To set a young person to work for success in examinations is almost wholly evil for both teacher and pupil.

Prof. H. F. Baker

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

This month we'd like to invite YOU to submit material for the site. We are inviting submissions of activities to include in the Numeracy Planning Assistant, so if you have any short activities that you would like other teachers to have access to, please download the template from:
http://www.nzmaths.co.nz/numeracy/NumeracyPA/NumeracyPA ActivityTemplate.doc Fill in the gaps and email it to andrew@nzmaths.co.nz. We will leave the name of the author at the bottom of all accepted activities.

## Diary Dates

Just a reminder that ANZ Maths Week this year is the fourth week of Term 3, i.e. 15 to 19 August 2005, although activities and competitions start at the beginning of Term 3. Information about this year's activities are available on the Maths Week site www.mathsweek.org.nz, with the activities, games and competitions starting 25 July, Week 1, Term 3. Resources from previous years are available all year at:
www.nzamt.org.nz.
27-30 September. 2005: NZAMT Conference to be held at Christ's College, Christchurch. For more details check the website www.nzamt9.org.nz/

## A Numeracy Project Update by Lynn Tozer

In the May Newsletter, No. 43 you will have read that by the end of 2004 some 14225 teachers had been involved in the Numeracy Project. Also outlined were the future directions for the project including the imperative to continue support teachers in sustaining quality numeracy classroom practice.

One key factor in continuing good numeracy practice in our schools is the work done by the Lead Numeracy Teachers. It is acknowledged that their role is vital, however their responsibilities are many. It is therefore critical that our Lead Teachers receive more support, and to that end there is a range of initiatives. These include more support and guidance workshops provided within each region, and a practical Lead Teacher Support facility on the nzmaths website to give detailed information on:

## Fostering a Professional Learning Community in Your School

Assistance with using data to raise student achievement, including a variety of processes to follow to use the data you have collected.

## Ongoing Professional Development in Numeracy

Ways to support the professional numeracy capability of the staff at your school including teachers new to the numeracy resources and yourself as a lead teacher. Includes plans for staff and/or syndicate meetings.
The NZ Number Framework and Teaching Model
Information to help deepen understanding of the New Zealand Number Framework and the Teaching Model. Includes plans for staff or syndicate meetings.

The numeracy facilitators working in schools in your region appreciate the work of all Lead Teachers and want to acknowledge how important their contribution has been and will continue to be to the mathematics achievement of our students. Thank you.

All teachers may find the following brief reminders from facilitators useful in honing their current practice:

- Don't forget that the Numeracy Planning Assistant is available on the website to support you with your planning. The tool calls on a range of appropriate lessons, not only the lessons in the numeracy material.
- Don't forget to use the equipment animations if you need to be reminded again of how to use a particular piece of equipment. More animations are in the pipeline.
- Remember in your lessons to keep the teaching model clearly in mind. Sometimes the critical imaging phase can get lost or hurried over. Remember less, done well, can be more.
- Include plenty of opportunities in your group lessons for students to explain their ideas and thinking to each other, then for students to report back on the thinking of their buddy. Remember teachers to actively listen often and not always to the one talking.
- Associate Teachers, please do give your trainee teachers the opportunity to be involved in your numeracy programme. Please don't just give them the other strands on their visits, despite the convenience and temptation to do so. Our newly trained teachers deserve every opportunity to be part of numeracy in action.

Some other good news on the numeracy front: in several regions there is now more support available specifically for teachers who are new to numeracy schools. Ask about it.

There is exciting numeracy work happening in our schools. Thanks to all for their efforts. We need to collectively maintain this momentum.

[Major supporters: Ministry of Education, Statistics NZ, and the University of Auckland]

- CensusAtSchool is coming our way again this year!
- Online survey $15^{\text {th }} \mathbf{A u g}-$ 9 $^{\text {th }}$ Sept 2005 (Maths Week launch)

In 2003, 18,000 students from 388 schools completed the online questionnaire. This year we hope to at least double this.

Megan Jowsey, Deputy Head, Auckland Girls Grammar School

"By taking part in the survey and then 'playing detective' with the data, students will discover interesting patterns and comparisons, that will bring their maths lessons alive." NZAMT President Alan Parris
"What is great about CensusAtSchool is that it generates a fantastic resource of data which is of interest to children to motivate and enrich their learning in statistics and can create a real buzz about statistics. But the reality is that teachers are heavily overworked and have many competing demands on their time. No matter how good the resource data is, most of us simply do not have the time to generate lots of new teaching and assessment resources ourselves for any one part of
 the curriculum. I am very pleased that the Ministry, Statistics New Zealand and everyone else involved in CensusAtSchool is taking this on board and that delivery of off-the-shelf resources will be a very high priority of this project.
"This is all great news for teachers but what really matters right now is that we all get our classes and schools involved so that the CensusAtSchool database is as rich and inclusive as it possibly can be. Then the project can move on and start delivering exciting resources for us to use. But if we do not all get in behind this project for the survey stage we really limit its ability to deliver its potential benefits to us and to our students.

## Vince Wright, National Numeracy Coordinator, NZ Maths Curriculum Project Coordinator

"CensusAtSchool will usefully complement the numeracy project and provide a vehicle for innovations in the curriculum. The data will form part of an international multivariate data base and provide opportunities for children to compare themselves with other children not only in New Zealand but also in the UK, South Africa, Australia and Canada."

Please register today www.censusatschool.org.nz

## Other Mathematics Web Sites

We came across these sites while reading a couple of Maths Associations' newsletters. Do other associations have newsletters with information that is worth spreading around?

Road signs: Thanks to the Otago Maths Association newsletter. We would have missed it otherwise. It seems that there is a new web site out there worrying about Road Sign Maths. The organisers of the site are looking for road signs exhibiting some maths and they'd like to give you a T-shirt for photographing these things. So what are they?

Well, they come in three basic categories (though there is no reason not to invent a new category for yourselves.) In Basic Math you're looking at road signs such as Montgomery 15 above Juneau 34 and Phoenix 49. Clearly $15+34=49$.

Then we get on to the Advanced Math category. Here we're looking for signs like Springfield 9 above Indianapolis 81 . The point here is that 9 is the square root of 81 .

Finally we have the Constant category. A sign like Boston 3 above Lansing 14 above Saint Paul 100 gives you an approximation to $\pi$ since $3+(14 / 100)$ is 3.14 which is approximately $\pi$.

So get out there with your cameras and send off your road signs to www.roadsidemath.com. Oh and send them off to us too so that we can put them in the newsletter.

We came across the next two sites from reading the Wellington Maths Association's newsletter.

Maths jokes: On http://www.xs4all.nl/~jcdverha/scijokes/1.html, you'll find some attempted humour. Here are two examples to see if you want to go further.

When a mathematician writes a fantasy book will the page numbers be imaginary numbers?

All the numbers went to a party and numbers being what they are. All the evens stayed around each other and all the odds did the same and neither group interacted with each other. Whilst two was chatting to four he notice zero was on his own in the corner and suggested to four that because zero is sort of even he should be encouraged to mix with even numbers. Four agreed. So off went two to invite zero into their little group. "Would you like to join our group?" enquired two. To which zero replied "I have nothing to add."

Incidentally if you have a maths joke we can certainly do with one in this newsletter.

## Patterns with Square Numbers

There are many patterns among square numbers. Have a look at these:

$$
\begin{aligned}
& 2^{2}+3^{2}+6^{2}=7^{2} \\
& 3^{2}+4^{2}+12^{2}=13^{2} \\
& 4^{2}+5^{2}+20^{2}=21^{2}
\end{aligned}
$$

Is this part of a general pattern?
How about these?

$$
\begin{aligned}
3^{2}+4^{2} & =5^{2} \\
10^{2}+11^{2}+12^{2} & =13^{2}+14^{2} \\
21^{2}+22^{2}+23^{2}+24^{2} & =25^{2}+26^{2}+27^{2}
\end{aligned}
$$

Is this part of a general pattern?
And again:

$$
\begin{aligned}
& 11^{2}=121 \ldots \ldots \cdot 1+2+1=4, \text { a square number. } \\
& 12^{2}=144 \ldots \ldots \cdot 1+4+4=9, \text { a square number. } \\
& 13^{2}=169 \ldots \ldots .1+6+9=16, \text { a square number. }
\end{aligned}
$$

Is this part of a general pattern?
The answers are not all yes.

## Solution to June's problem

Last month we asked you to do some arithmetic with all the ten different digits 0 to 9 . What five-digit number when divided by another five-digit number (each of the ten digits being different) gives the answer nine?

So, place the ten different digits from 0 to 9 in the boxes shown. Remember that fivedigit numbers don't begin with a zero and that the numerator is an odd number.


We got this thoughtful and very good solution from Stewart Saunderson who lives near Dunedin.
"Hey, I saw this month's math problem and I worked out the answer. It is 95823/10647 and here's how I worked it out:

1. I worked out the first digit of the numerator must be 9 and the first of the denominator would be 1 this is because 9 divided by 1 equals 9 .
2. I worked out the second number of the denominator must be 0 because the highest numerator possible is 98765 which means the highest denominator possible is 10973.8* (just divide numerator by 9) and the lowest possible denominator is 10000 because the lowest numerator is 90000 and you just divide that by 9 . So therefore the denominator is between 10000 and $10973.8^{*}$ meaning the second digit of it must be 0
"Note: the numbers left now are $2,3,4,5,6,7,8$
3. The last digit of the numerator can only be: $3,5,7$ because it must be an odd number. If you were to say it was 5 , then the last digit of the denominator would have to be 5 (you go 9 multiplied by 5 to work this out) which isn't possible because you would have to use 5 twice. So that leaves 3 and 7 as possibilities. So if 7 was the last digit in the numerator, then 3 must be the last digit in the denominator. Now for the fraction to work both the numerator and denominator must be a multiple of 9, and to check this every digit in either number must add to a multiple of 9 . So far in the denominator, assuming 7 was the last digit in the numerator, the digits add to 4 with 2 spaces left so we need the last 2 spaces to add to 5 or 14 or 23 etc.
"Note: If we assume 7 is the last digit of the numerator then we have the number 2, 4,5,6,8 left.
4. The least the 2 digits can fill in the space for is 6 and the most 14 . So if 7 as the last digit was right then the denominator must be 10863 or 10683 . Neither of these works so this means that 7 is not the digit of the numerator.
5. The only possibility left for the last digit of the numerator is 3 and that means the last digit of the denominator is 7 . The digits of the denominator add to 8 with 2 spaces left so the last 2 spaces must add to 10 . The only possibilities to make 10 with the numbers left $(2,4,5,6,8)$ is 2 and 8 or 4 and 6 . Therefore the possible numbers for the denominator are: 10287, 10827, 10467, and 10647.
6. After multiplying all these numbers in turn by 9 the only number that results in a new number that doesn't use any of the already used numbers is 10647 and its result of 95823.
7. So that gives the answer of $95823 / 10647$.
"The other possible answers if you forget that the numerator must be odd are 97524/10836 and 95742/10638."

This Month's Problem

Two cubes with integral sides have their total volume numerically equal to the difference in their surface areas. What are the sizes of the cubes?


We will give a book voucher for 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 Last Month's Junior Problem

In May we ran our first Junior Problem. The question was: Amal has two bottles. One can hold 300 ml and the other 500 ml . Can she measure out exactly 100 ml ? If not, why not? If she can, what is the smallest number of times she used the 300 ml bottle?

Now you may think that problems of this kind have no practical applications but we have been informed (indeed we should have known!) that the problem is very close to one that caused Bruce Willis and Samuel L. Jackson some grief in Die Hard: With a Vengeance (1995). Here they found themselves with a five gallon jug and a three gallon jug, and they had to put exactly four gallons of water on a scale to keep a bomb from exploding.

So you never know when maths is going to come in handy.
Last month's question was as follows.
The Otahoehoe Post Office has only 40c and 50c stamps. Prunella wants to send a packet that is going to cost her $\$ 4.50$. In how many different ways can she make up this amount of postage just using the stamps available?

The winner is Larson Atkins from the R14 Maths group, Gisborne Central School. His three answers were:

1. $9 \times 50 \mathrm{c}$
2. $5 \times 40 \mathrm{c}+5 \mathrm{x} 50 \mathrm{c}$
3. $10 \times 40 \mathrm{c}+1 \times 50 \mathrm{c}$

Well done Larson.

## This Month's Junior Problem

Anyway let us remind you that this section contains a monthly problem competition for students up to Year 8 . We're giving a $\$ 20$ book voucher to the best correct solution sent in to the problem below. And we mean solution; we won't accept just a 'yes' or 'no' or number answer. That is, we need some explanation of how the answer was obtained.

So this month we're still at the Otahoehoe Post Office. They still have only 40c and 50c stamps. And Prunella knows that she can make up any amount of postage that's a multiples of 10 from $\ldots$ onwards. What is the magic number that's missing from the last sentence?

## Afterthought

Just so that you don't have to wait till next month, here are some answers to the Patterns With Square Numbers.

The first pattern is a pattern. If you let a stand for the first number, then a +1 is the second number and $a(a+1)$ is the third, the product of the other two. The number on the other side of the equation is one more than this product and so is $a(a+1)+1$. And if you do your algebra correctly you'll find that

$$
a^{2}+(a+1)^{2}+[a(a+1)]^{2}=[a(a+1)+1]^{2} .
$$

You can check this out by putting $\mathrm{a}=5$ to give

$$
5^{2}+6^{2}+30^{2}=31^{2}
$$

Did you manage to find a sum of the squares of five consecutive that is equal to the sum of the next four consecutive numbers squared? Did you get something that had 40 as the last square on the left side? And did that inspire you to 60 for the next case? So why are $4,4 \times 3,4 \times 6,4 \times 10,4 \times 15, \ldots$ key numbers? And what is the significance of $1,3,6$, $10,15, \ldots$ ? Triangular numbers again?

Finally, of course $14^{2}$ is a problem. $14^{2}=196$. And $1+9+6$ isn't, $\ldots$ Oh yes it is. And $15^{2}-$ yes it is. But what about $16^{2}$ ?

