Newsletter No. 23 **May 2003**

Reading John Stillwell's item on Pythagorean triples in the last newsletter set me wondering how many of us use the history of Maths in our teaching. For subjects like Art, Music and English it is customary for teachers to use accepted masterpieces in their teaching - the great paintings, symphonies, novels and plays. Classes study them to acquaint themselves with some of the creative milestones of the subject and gain knowledge of the standards by which other work is measured.

What would be an analogous approach in mathematics? Would we study some of the key mathematical discoveries, some of the more important theorems in the history of the subject? If so, which ones would they be? When I was a pupil brought up on Euclidean geometry we were shown various proofs of Pythagoras' theorem. I'm not sure whether they were in the syllabus or whether we were just following the interest of the teacher. Would Pythagoras' theorem rate as one of those accepted masterpieces for mathematics? I have looked at Archimedes method for determining circular area (based on Eudoxus' method of exhaustions) with Sixth Formers and Heron's formula for triangular area with Seventh Formers. Could either of these be considered as masterpieces of mathematics?

What others might there be? Proof of the irrationality of $\sqrt{2}$ comes to mind and Euclid's method of showing the infinity of primes. Perhaps you have some other ideas. Whether you look at old theorems or not, the nzmaths website has a wealth of ideas to enrich your teaching.

> *We need to examine history carefully to see what epistemological Message it carries - about the nature of mathematical activity, the way its concepts develop, the choices the mathematicians have and those they have not made.*
>
> David Wheeler

What's new on the nzmaths site this month?

Finally we have got seven Bright Sparks on line. These are Diamonds, Double Trouble, Frogs, Round Table, Six Circles, Sole Survivor, and Toni's Tiara. We hope that you will encourage your students to have a go. We'd like to hear form you about how they go, if they have any problems, and what they enjoyed best. Two more are being planned.

Now one of the things that we have found insuperable is getting student feedback via the computer. By getting their way past the various obstacles we can tell that they are making progress but we don't know if they can write some mathematics to justify what they are doing or whether they are just going on intuition. Consequently we'd like you to get your students to write to Derek at derek@nzmaths.co.nz telling him how they knew what to do. In this way we hope that not only will their intuitions be honed through the Bright Sparks problems but that they will also begin to see how to express themselves mathematically.

Ten new links have been added in the Links section of the site. Instead of ten links a month, this year we will be adding a total of thirty new links in three groups of ten. This is the first ten for the year.

New Zealand Curriculum Exemplars

Have you seen the exemplars yet? There are three sets of English exemplars (around writing), and seven sets of Mathematics exemplars published so far; these should have been distributed to every school in New Zealand during April (they are in a big yellow ring binder).

The sets of Mathematics exemplars have each been developed to exemplify a key progression in mathematics across Levels 1-5. These key progressions are:

- Number: Fractions
- Number: Number Strategy
- Algebra: Exploring Patterns
- Measurement: Measuring
- Geometry: Tessellations
- Statistics: Data Display
- Statistics: Probability

Within each set there is a backed A4 page of information around each key stage in the development of that key progression. The information includes; authentic student samples, a description of some features of student work at that stage in the progression, a sample teacher/student conversation, information about what a student at that stage should be learning next, and links to curriculum objectives, Figure It Out activities, and, of course, nzmaths units.

The key goal of the mathematics exemplars is to support teachers' understanding of progressions in mathematics. While only seven progressions have been developed as exemplar sets (and one of these is Number Strategy, which is purely a description of the Number Framework from the Numeracy Development Projects), the Mathematics exemplar matrix leaves spaces to show that there are other key ideas in mathematics to be explored. Possibly you, or a group of teachers from your school could develop a progression around one of these 'gaps'. We would be very interested to hear from anyone who does so.

Diary Dates

The New Zealand Association of Mathematics Teachers is planning its 8th annual conference from the 8th to the 11th July 2003 in Hamilton. The updated list of plenary speakers is: Vaughan Jones, Kaye Stacey, Laurinda Brown, John Edwards, Jeff Witmer, Harry Henderson and Anthony Huffadine.

For more information contact;
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And just an early reminder that Maths week for 2003 is 10-16th August.

For other events organised by the NZAMT consult their website at www.nzamt.org.nz/

A Touch of Nostalgia - supplied by Bob Carr

If a postage stamp is 1 inch long and 5/6 inch wide, how many stamps would be required to cover the walls of a room 18 feet long, 14 feet wide and 10 feet high? This was one of the problems found in 'A Shilling Arithmetic' by S.L.Loney and L.W. Grenville printed in 1921. It's mind-boggling, the level of arithmetic that was expected of young people of that era, and all without the aid of electronic calculators. How would they actually have gone about solving the problem, one wonders? Perhaps something along the lines of the following ….

"Hmm…", thought Arthur, "… a fair-sized room, only one window, and the door of course …". The window could easily be covered in stamps, although it would be a bit tricky round the edges. He would have to tear the sheets into strips to fit them round the curved bits. Of course, that would affect the area a bit. Still, he couldn't put stamps on the door handle so that would offset the error slightly. The fireplace was bricked in and plastered smoothly, so that was all right.

Down to the main post office. The local one had closed because it was too convenient.
"I'd like 110592 penny stamps please. No! Make that … ", he paused, calculating, " … 121651 penny stamps", said Arthur. He reckoned that ten percent should cover the curved bits.
"Sorry mate. There's no call for penny stamps these days. Cheapest we have is $4^1/_2$d."
Arthur calculated again. 13 minutes later he contemplated the result; £2112: 4s: $1^1/_2$d.
"What about a discount for buying in bulk?", he asked.
"Sorry mate."
"But you're a state-owned enterprise! What about cost efficiency?"
"We're a monopoly too mate. Take it or leave it."

Arthur reckoned he could stick three sheets of 50 stamps up in a minute. That meant $13^1/_2$ hours of solid sticking, plus the curved bits. If he allowed himself a couple of tea breaks, 15 hours should see it done. Somehow, after the first few hours his pace fell off. The excitement had gone out of it all. Still, he stuck to his task.

When he had finished, he lit the oil lamp in the darkened room, lay on his back and thoughtfully contemplated the bare ceiling. 14 feet by 10, 20160 square inches…., 24192 stamps at $4^1/_2$d ….

Somehow, he'd lost interest.

Is 9 a factor?

In May we mentioned a test to decide whether or not 3 would go into a given number. This month we look at the same question with 3 replaced by 9. How can we tell if a number, 6789270015162, for instance, is divisible by 9?

Now we are sure that you'll agree that this is the sort of question that you get asked every day so it's obviously very important that we should know and that we should tell our students. So here goes.

> ***Add up all the digits and see if that number is divisible by 9. If it is, then so is the original number.***

Remember the test for 3? It's exactly the same. If you want to know why it works we'll show you for any 4-digit number. For any other number of digits, 13 say, the idea is the same – it just takes longer to do.

Let the 4-digit number be abcd. Then abcd = 1000a + 100b + 10c + d = (999a + 99b + 9c) + (a + b + c + d) = 9(111a + 11b + c) + (a + b + c + d). So if (a + b + c + d) is divisible by 9, then abcd must be as 9(111a + 11b + c) surely is.

Yet another web site

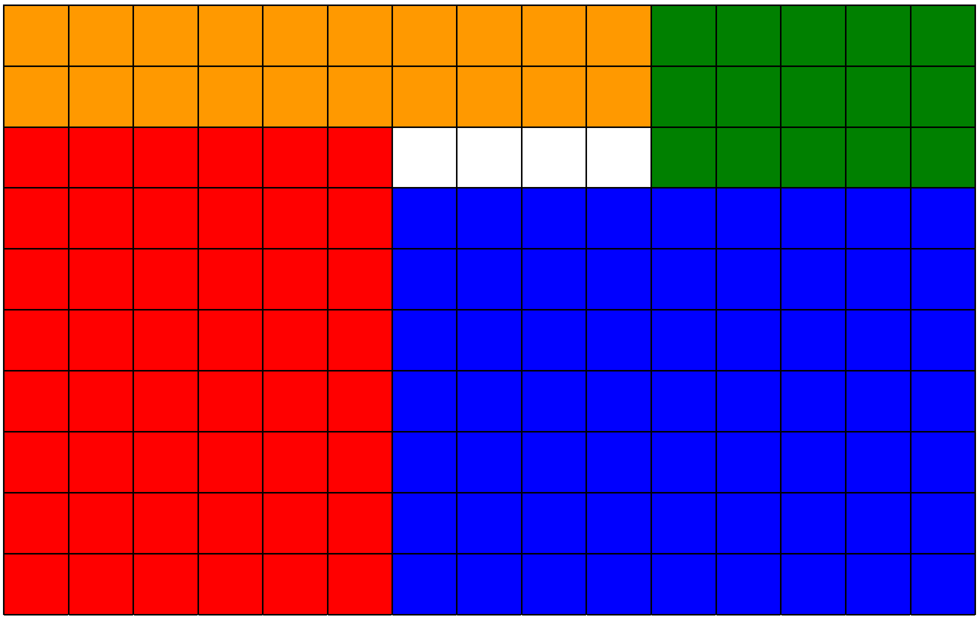
We recommend a look at the site below. Now we realise that you can find a lot of things on the internet but this is the first time that we've found anything that could read our minds!! Let us know what you think. We'd like to put your interpretations of this in next month's newsletter. You might like to discuss it with your students and with other members of staff. Let us know what they think.

http://mr-31238.mr.valuehost.co.uk/assets/Flash/psychic.swf

Solution to April's problem

Cathy Walker is this month's winner of the petrol voucher prize of $50.

In last month's problem you were asked to dissect a rectangle into five smaller rectangles such that no two of their sides have the same length and only the lengths 1 to 10 are used. We gave you a couple of the rectangles and they were 3 by 5 units and 6 by 8 units. Here is Cathy's solution.



The squares that she used were 1x4, 2x10, 3x5, 6x8, and 7x9.

This month's problem

The so-called 'magic squares', where numbers in rows, columns and diagonals have the same sum, have been popular for over a thousand years. According to Henry Dudeney, perhaps the leading mathematical puzzlist of all time, squares with rows, columns and diagonals having the same product were first mentioned towards the end of the eighteenth century. He revived them in 1897 when he offered the challenge of placing nine different numbers in a three-by-three square so that the ***product*** of those in each row, column and diagonal was the same and the least possible value. You might like to check that the least value is 216 and that the nine numbers are 1, 2, 3, 4, 6, 9, 12, 18 and 36.

Our problem for you is to place the whole numbers from 1 to 7 inclusive and 10, 12, 14, 15, 18, 20, 21, 24 and 28 in a four-by-four square such that the product of the numbers in each row, column and diagonal is the same. To ensure a unique solution we have placed four of the numbers for you. You still might think the problem is one of trial-and-error and although it could be solved that way there is an alternative approach which rests on …. well, that would be giving the game away. See how you get on.

		15	
			5
		28	18

Each month we give a petrol voucher to one of the correct entries. 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. And if you don’t have the time to do the problem yourself, give it to your class to do. So far this year we haven’t had a student winner but we have had them in the past. Get them at it.