Newsletter No. 9 **November 2001**

American Scholastic Aptitude Tests in the 1980s showed boys achieved better than girls in mathematics. For example, among the top three percent of achievers there were two boys to every girl and among the top 0.2 percent the ratio was 13 to one in favour of boys. Tests elsewhere seemed to undermine the idea that social conditioning was the cause. According to a report in New Scientist Magazine (29 May 1986) from a study of 100,000 extremely bright American children, brilliant mathematicians were likely to be male, suffer from allergies, be left-handed and myopic. It was suggested that exposure in the womb to high amounts of testosterone could be the cause. I wonder what they're thinking now when we see the reverse phenomenon occurring – girls outdoing boys at mathematics.

Reading recently of the death of New Zealand war hero Lieutenant-Colonel Lawrence 'Curly' Blythe, whose life spanned three centuries, reminded of that delightful problem devised by recreational mathematician Martin Gardner. You might like to give it some thought (and wonder why Curly Blyth's life reminded of the problem):

> When asked how old she was, she smiled and said cryptically, "The day before yesterday I was 22 but next year I'll be 25." When was her birthday and on what day did the conversation take place?

In last month's introduction we mentioned how a Japanese team are using lasers to carve items 150 nanometres across. I thought you might find it helpful to have a table showing the metric prefixes, their meaning and derivation. You'll find it below.

But now I'd better let you get on with reading the newsletter.

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WHAT'S NEW ON NZMATHS SITE THIS MONTH

This month we have added ten activities to the number facts aspect of the number component.

NZ SCIENCE, MATHEMATICS AND TECHNOLOGY TEACHER FELLOWSHIPS

The Royal Society of New Zealand administers the NZ Science, Mathematics and Technology Teacher Fellowships. Details of these can be found on http://www.rsnz.govt.nz/awards/teacher_fellowships/index.php

Here's the list of Teaching Fellowship winners in mathematics for 2002.

Mathematics:

- Geoffrey Ackerley – Ashburton College, Canterbury *"Statistical applications in environmental issues "* hosted by Central South Island Fish & Game Council.
- Steve Connor – St Bede's College, Christchurch *"Mathematics and Statistics in Action"* hosted by Lincoln University.
- Jeremy Lane – Mangere College, Auckland *"The mathematics in Local Government with particular reference to town planning"* hosted by the University of Auckland.
- Saraswathy Nataraj – Selwyn College, Auckland *"Exploring Mathematics in Indian Culture"* hosted by the University of Auckland.
- Carolyn Vela – Maungawhau School, Auckland *"CAMPS- Collaborative Analysis of Mathematics Primary Software."* hosted by the University of Auckland and Edsoft.
- Glennis Williams – Oxford Crescent School, Upper Hutt *"Statistical Analysis"* hosted by AgResearch Wallaceville.

You might have thought at some stage that you would like to apply for a Teaching Fellowship. Ideas for enriching your classroom teaching may have occurred to you and you may have wished that you had the time to explore them more fully. If that's the case it's certainly worth giving the idea more thought and you might like to consider the following points to help plan a proposal for 2003:

First, the Fellowships are not just for the production of resources. You probably should produce new material to help pass on the benefits of your experience during your Fellowship year but producing material or giving workshops should not be your main thrust.

Second, you should remember not to be totally altruistic. The Fellowships are designed for teachers to gain professional development and experiences that will help their personal growth. So consider what you can learn in the Fellowship year and how this might promote learning in your future students.

Third, give a great deal of thought to your project so that the panel who consider your application can see precisely what you hope to do and how you plan to achieve it. For example, if you were thinking of looking at how statisticians are employed in the fishing industry and what contributions they make there, it may not be good enough to say "I'll contact MAF and get hold of 10 statisticians and follow them around for 6 months." Rather you should contact MAF before writing your proposal (and probably the main fishing companies and even some university department or two) to find out in advance how many statisticians are employed directly or indirectly in the fishing industry. Contact several of them to find out what they actually do and see how you could work in with them in some way. This will help you to think about the size of the task, how you might collect data, and how this might ultimately be relevant in the classroom. Try to work through in some detail how you plan to spend the year, who might help you, and what the outcomes might be. That way you'll be able to present a better application.

And finally, although this is a maths web site, there is no reason why you shouldn't apply in some other area. After all, Fellowships are also granted in the areas of social sciences, science and technology.

Details of the successful primary teachers' projects for 2002 have been included here to give you a feeling for the kinds of things that were proposed this year. If you would like further details of the Fellowships, please contact Peter Spratt at the Royal Society of New Zealand.

Carolyn Vela of **Maungawhau School, Auckland,** will be hosted by the Mathematics Dept of the University of Auckland and Edsoft as she carries out an investigation into the effective use of software and Internet in primary mathematics with regards to providing more meaningful contexts for learning and problem solving in mathematics. As she does this, Carolyn will be developing criteria for the evaluation of mathematics software and web-sites which could then be used by others. She will also be promoting links between schools, The University of Auckland, and businesses interested in promoting quality use of computers in primary school mathematics programmes.

Glenys Williams from **Oxford Crescent School, Upper Hutt**, will be developing her knowledge and understanding of calculus and statistics as she works with the bioinformatician at AgResearch Wallaceville. She will be involved in a number of current research projects at AgResearch and will work on the data obtained to develop her skills. Glenys will also be able to promote the importance of mathematical skills that are used in such scientific and technological applications and in surveys conducted for social science purposes by involving students and staff from local schools in data collection and analysis.

Rena Heap, Woodlands Park School, Auckland, will be exploring the science and technology in the Waitakeres hosted by Watercare Services Limited and the Auckland Regional Council. Rena will broaden her knowledge and interest in conservation issues from scientific and technological perspectives and will work with Watercare to increase her knowledge of water resource management and conservation. She will learn the procedures of water quality monitoring, carry out research into the differential mortality of seabird species after storm events at Whatipu Beach, and promote young people's interest and greater scientific awareness towards environmental issues

Kerry Hinton of **Maidstone Intermediate School, Upper Hutt** will be hosted by the Upper Hutt Economic Development Agency to enhance her knowledge of how science underpins business activities in the community by investigating local enterprises such as a hairdresser, the City Council Pest Control unit, Schering–Plough Animal Health, Resene Paints, Horokiwi Quarries, the Police Forensic Lab, and AgResearch. This will enable her to develop contacts within the community that can enhance school classroom science programmes, develop improved communication pathways between schools and local enterprise and use business to authenticate and validate classroom learning. Like other Teacher Fellows, Kerry will also be improving her ICT skills to assist her in her work and share information with others.

Adrienne Leng will spend her Fellowship working with horizons.mw (Manawatu Regional Council) investigating the biodiversity of wetlands. From **Ashhurst School** she will be involved in developing an inventory of wetlands in the Manawatu-Wanganui region and assessing their degree of biodiversity and sustainability. Adrienne will be able to interact with a wide range of organizations such as the local Wetlands Trust, Palmerston North City Council, DOC, local iwi, Forest and Bird Society, Ashhurst Action Group, Institute of Natural Resources (Ecology) at Massey University and Ducks Unlimited, all of whom have connections with the Ashhurst Wetlands, to establish communication pathways to encourage the progression of this Wetlands' development and to allow the school to be more involved;. With such a wide range of expertise to draw from, Adrienne will increase her knowledge about the management, development and biodiversity of wetlands and be able to promote this to colleagues, students and the wider community.

Gail Mitchell from **Rukuhia School, Hamilton** will "Go Bats! In the Waikato" and work with DOC on their research into local populations of bats, their effect on local ecology and the effects of external influences on the bat communities. She will develop monitoring programmes to establish long term monitoring of local bat populations, and promote this to local communities.

William Taylor from **Raroa Normal Intermediate School, Wellington**, will be hosted by the Science Faculty of Victoria University as he works on providing a visual perspective on the geological and biological history of Aotearoa - through the creation of original artworks utilising a cross-curricular approach. Bill is the Art specialist at his school and will be using his Fellowship to develop his knowledge in earth and biological sciences and further explore the interdependent nature of science and the visual arts and so "bridge the gap" to represent science as a human, passionate subject. The end of the year will be marked by a public exhibition illustrating the interdependence of Art and the Sciences in an exciting and pertinent way.

Sherryl Allen of **Mangaroa School, Upper Hutt**, will be working with the Ministry of Culture and Heritage and the Waiouru Army Museum as she develops research and information skills through working in authentic research situations. Sherryl will be part of the research team in the prisoner of war project being carried out by the Ministry. She will then be able to take what she has learnt and develop her ability to translate research information into forms suitable for young people, particularly Year 1-3 pupils. Sherryl will also be completing an Honours level History paper at Victoria University.

Lois Hawthorne, Cobham Intermediate School, Christchurch will be hosted by the New Zealand Historic Places Trust/Pouhere Taonga as she develops her social science research skills while carrying out a study of the Lyttelton Timeball Station. While involved in this, Lois will be learning more about time keeping, navigation and associated technologies and scientific developments to develop a greater understanding of the Timeball Station and other associated local heritage sites, and natural resources. This will also allow her to gain an insight into how individuals, community groups, councils, business interests and other stakeholders resolve conflicting interests over such heritage resources, thus giving a useful background from which to promote heritage preservation.

Neil Rogers of **Te Whare Kura o Rakaumangamanga, Huntly** will be hosted by the Science and Technology Education Research Centre of Waikato University as he works on his Fellowship "Hangarau Ki roto I te Toi me te Mahi Toi Maori". This will allow Neil to develop his knowledge of the technological knowledge and practices that underlie the work at the NZ Maori Arts and Crafts Institute in Rotorua as well as developing his understanding and skill in the work undertaken there. This will provide a unique opportunity to look at current technological practice and make historic comparisons.

(We would like to thank Peter Spratt for his help in preparing the above.)

CURRICULUM STOCKTAKE

The curriculum stocktake project is now more than halfway through. The last few months have involved a lot of information gathering, as the team has met with many principal and teacher groups and has held consultation days around the Mathematics/Pangarau, Science/Putaiao, and Language and Languages/Te Reo me Nga Korero learning areas. Summaries of the issues raised at these meetings are available on http://www.tki.org.nz/r/stocktake/, along with other information about the project. The stocktake team has also met regularly throughout this process with a reference group of key stakeholders. This group has served as a sounding board for the Ministry's thinking, and has provided a link back into most parts of the sector.

Other aspects of the project are more recently under way, such as the School Sampling Study questionnaires which are in schools at present. This is a 3 year research project which will investigate how the curriculum is being implemented and managed in a 10% random stratified sample of schools. The current questionnaires focus on Mathematics and Technology. The international review process has also just been settled, and contracts have been signed with two groups of curriculum experts. They will provide independent commentaries on the New Zealand Curriculum Framework and statements, and the extent to which they represent international good practice.

The stocktake team within the Ministry is due to provide the Minister with a report about future directions for curriculum renewal and review early in 2002. Please visit the TKI website to have your say, or email: curriculum.stocktake@minedu.govt.nz.

(We are grateful to Amanda Speer from the Ministry of Education for putting the above information.)

TABLE OF METRIC PREFIXES

Multiples:

Prefix	Abbrev -iation	Power of 10	Equivalent	Origin
deka-	da	1	ten times the base unit	Greek = ten
hecto-	h	2	a hundred times	Greek ‘hekaton’ = hundred
kilo-	k	3	a thousand times	Greek "khilioi’ = thousand
mega-	M	6	a million times	Greek ‘megas’ = great
giga-	G	9	a billion times	Greek ‘gigas’ = giant
tera-	T	12	a trillion times	Greek ‘teras’ = monster
peta-	P	15	a quadrillion times	alteration of ‘penta’
exa-	E	18	a quintillion times	alteration of ‘hexa’
zetta-	Z	21	a sextillion times	Italian ‘sette’ = seven
yotta-	Y	24	a septillion times	Italian ‘otto’ = eight

Fractions:

Prefix	Abbrev -iation	Power of 10	Equivalent	Origin
deci-	D	-1	one tenth of the base unit	Latin = tenth
centi-	C	-2	a hundredth	Latin ‘centum’ = hundred
milli-	M	-3	a thousandth	Latin ‘mille’ = thousand
micro-	µ	-6	a millionth	Greek ‘mikros’ = small
nano-	N	-9	a billionth	Greek ‘nanos’ = dwarf
pico-	p	-12	a trillionth	Spanish ‘pico’ = little bit
femto-	f	-15	a quadrillionth	Danish ‘femten’ = fifteen
atto-	a	-18	a quintillionth	Danish ‘atten’ = eighteen
zepto-	z	-21	a sextillionth	alteration of ‘septi’
yocto-	y	-24	a septillionth	alteration of ‘octo’

Notes:
The prefixes in everyday use are: milli- as in milligrams, centi- as in centimetres, kilo- as in kilowatts, hecto- as in hectares and mega- as in megahertz.

Those in less common use are: micro- as in micrograms, deci- as decibels, giga- as in gigabytes and nano- as in nanometres..

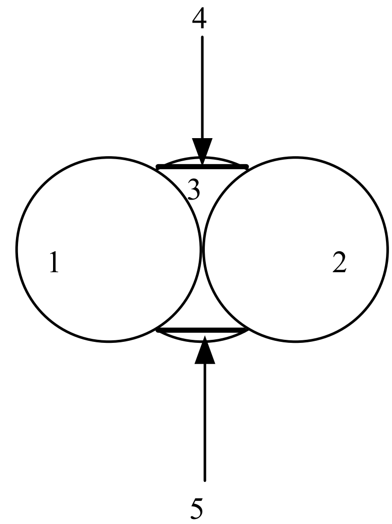
The September 2001 edition of Scientific American has a special feature on nano-technology which provides fascinating reading and an insight into the very small. It's well worth a read.

THE OCTOBER SOLUTIONS

Under the heading 'Yet more on July's problem' we left you with a couple of new ones.

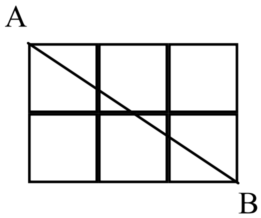
The first was to arrange five coins (all the same size) in such a way that each touches the other four…

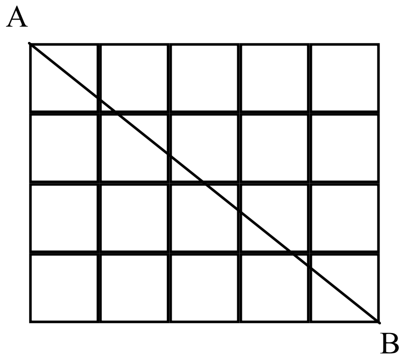
Well, here's how it's done. Place coins 1 and 2 on top of 3 as shown. Stand 4 and 5 on their edges across the exposed parts of 3 and hold them together so that they touch each other.



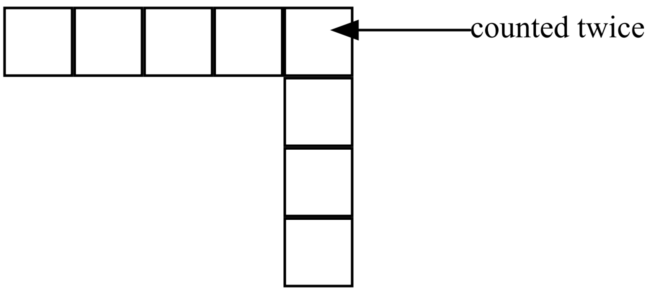
The second problem was to find the number of ways it's possible to make change for a dollar, using any combination of 5, 10, 20 and 50 cent coins. One obvious method is to list them all. That's O.K. as long as you remember to be systematic in your listing, that way you can be reasonably sure you haven't left any out (and, of course, it may suggest shortcuts). Obviously the dollar can be replaced by two 50¢ coins. One way of proceeding might be to keep one 50¢ coin and look at the number of ways the other can be replaced, working from higher denominations downwards. Repeating the process with the second 50¢ piece should lead you to the solution that there are 50 ways change can be given for a dollar.

As for Marie and Wiremu's problem concerning the diagonal line across the town-square (which wasn't quite a square if you remember). Well, this problem really gives a visualisation of the idea of highest common denominator, not that you needed to know that to solve it. The town 'square', which we'll call a rectangle from now on, was 99 squares by 100. Playing around with smaller rectangles like two by three or four by five leads to the following …



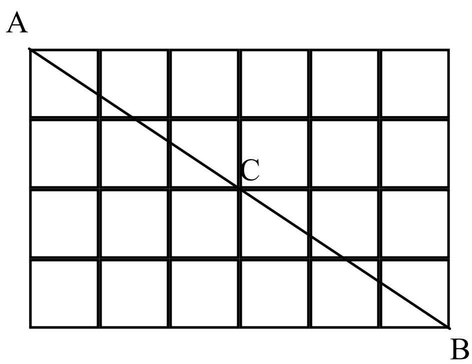


As the diagonal line is drawn from corner A to corner B it travels across the length of the rectangle, therefore it crosses that number of squares. It also travels down the width and crosses that number of squares. When these squares are drawn as an L-shape you can see that one square appears in both the length and width and is counted twice.



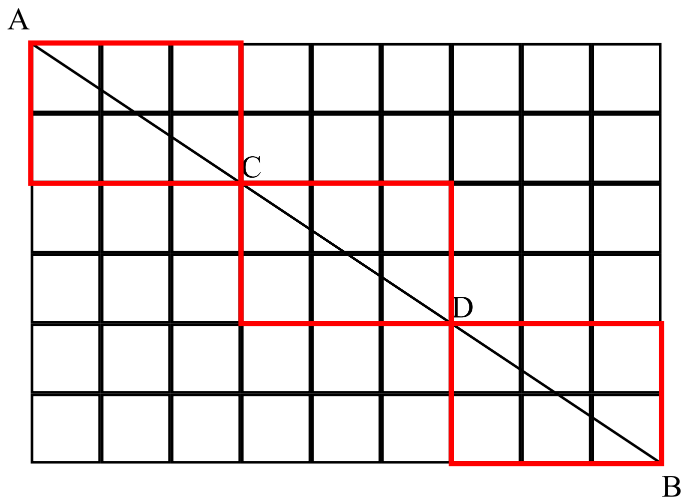
Hence the number of squares that the diagonal crosses is equal to the number in the length added to the number in the width minus one. For the town square in Marie and Wiremus's problem that is 100 + 99 – 1 = 198.

However, there was that other problem that Marie and Wiremu found when the town square (rectangle) was 95 by 100 or 98 by 100 squares. Let's look at a simpler example of a rectangle four squares by six.



Here the diagonal does not cross 4 + 6 – 1 squares because it passes through C, a point where the corners of four squares meet. Such points occur when the length and width of the rectangles have a common divisor. Exploring the idea further we can see that for a rectangle six by nine squares the diagonal passes through two 'corner' points C and D.

Two numbers that have no factors in common are called ***mutually prime***. Six and nine are not mutually prime as they have a common divisor of three.



In the above diagram the six by nine rectangle can be thought of as made up of nine smaller rectangular blocks, three are coloured in red, each with (mutually prime) sides two by three. The diagonal goes through three of these when it travels from A to B via C and D and the number of squares it passes through is 6 + 9 – 3 = 12.

This pattern generalises, for example, the diagonal of a six by ten rectangle passes through two blocks of three by five squares (and two is the common divisor of six and ten). It passes through 6 + 10 – 2 = 14 squares.

The solutions to Marie and Wiremu's other two town square problems are:

- For the 95 by 100 'square' the diagonal crosses 95 + 100 – 5 = 190 squares; and
- For the 98 by 100 'square' 98 + 100 – 2 = 196 squares.

THIS MONTH'S PROBLEM

We thought you or your students might like to have a go at an alphametic prior to winding down the year. Alphametic is the name given by J.A.H. Hunter in 1955 to the type of puzzle in which numerical digits in an arithmetical calculation are replaced by letters of the alphabet, the words so formed making a sensible phrase. Hunter was the author of a syndicated puzzle column read throughout the U.S. and Canada. Michael Maynard from Wellington, who may be New Zealand's leading compiler of additive alphametics, suggests that the best ones should not only make sense but contain all ten different digits.

See if you can solve this seasonally appropriate alphametic. Each different letter stands for a unique digit and the arithmetic holds true.

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HAPPY
HAPPY
HAPPY
  DAYS
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AHEAD
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This is our last newsletter for the year. The next newsletter will circulated at the start of February 2002.

Best wishes for the holiday break.

Russ, Derek, Gill & Joe.