Newsletter No. 72 **April 2008**

For a while now we have included Booke Reviews in the newsletter - the spelling booke, of course, is to indicate that the publication being described is not a recent one! The most obvious way we can understand the development of mathematics is through the written word, usually in the form of books because they are the most accessible. Many of these mathematical contributions have changed or influenced the course of human action but not all those we consider have done that. Some, like those written by Lewis Carroll, H.E. Dudeney and Martin Gardner, are included for their recreational interest. They bring the subject within our ken, as the Scots say, to understand and enjoy. Others, like *Algebra for Beginners* by Isaac Toddhunter and *Prelude To Mathematics* by W. W. Sawyer are more important in the education of mathematics. Still others, like John Venn's book included in this issue, are significant in the study of mathematics itself. A few more like Isaac Newton's *Principia Mathematica* are really important. They stand out as landmarks in the furtherance of human knowledge. So, read on, enjoy the Booke Reviews and everything else in the newsletters - keep in touch with mathematics, then and now.

> *Mathematics is a reflective activity, an activity of the mind aware of its own powers.*
>
> **David Wheeler**

72^5 is the smallest fifth power which can be expressed as the sum of five other fifth powers, namely, $72^5 = 19^5 + 43^5 + 46^5 + 47^5 + 67^5$.

Jomo Kenyatta became Prime Minister of Kenya at age 72 and Colette was that age when she published her popular book *Gigi*. The mathematician Gaspard Monge died at age 72, as did Douglas Bader, Confucius, Henry James, John Locke and John Wayne.

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What's new on nzmaths.co.nz

We have added two new Learning Objects to the site, with a unit describing how each can be used. The Learning Objects are The Percentage Bar and Mix Up, both of which are available from this page:
http://www.nzmaths.co.nz/LearningObjects/N4.aspx

The units are in the Number section of the site:
http://www.nzmaths.co.nz/Number/Operatingwithno.aspx

World Math's Day

So how many of you managed to get registered for World Math's Day? You might want to check out the web site: http://www.worldmathsday.com/. This will show you that over a million mathletes from more than 20,000 schools in over 150 countries answered 182,455,169 questions correctly.

The top Kiwi mathlete was Damien L of Team New Zealand. He answered 41,399 questions correctly. How on earth do you do that in 48 hours? Does anyone know who Damien is? Can we have a photo? Unfortunately Damien was only (only!) 19th in the world. But even more unfortunately he was beaten by five Australians one of whom topped the competition with 65,199 correct answers.

So get into practice now for next year. Registrations open in February. In the meantime you might like to Google 'world maths day' and see some of the hype around the event – it even got onto Australian morning TV!

Actually this was how I got onto Maria Miller's blog at http://homeschoolmath.blogspot.com/2008/02/world-math-day-challenge.html. You might find several interesting things there.

Incidentally has anyone got a maths blog that we can talk about next month?

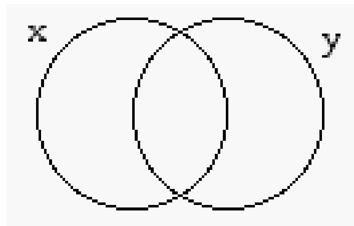
Booke Review

Symbolic Logic by John Venn

John Venn was born in Devonshire in 1843 and was the eighth generation of his family to study at Cambridge (to be followed by a ninth). He had a long association with Gonville and Caius College that lasted seventy years and among other things he lectured there.

He wrote three important works that became standard texts almost at once. *Symbolic Logic* published in 1881 was the second of these. It contained Venn Diagrams, the system of overlapping circles or other figures for representing given premises. Shaded regions were used to designate an empty class (or set as it is now called). Here's how the book opened the subject:

> Our primary diagram for two terms is thus sketched:



> On the common plan this would represent a proposition, and indeed is commonly regarded as standing for the proposition 'some x is y', although it equally involves in addition the two independent propositions 'some x is not y', and ' some y is not x'. With us, however, it does not as yet represent a proposition at all, but only the framework into which propositions may be fitted. That is, it indicates only the four combinations represented by the letter compounds xy, $\bar{x}y$, $x\bar{y}$, $\overline{xy}$.

When the work was first published it became cutting edge for the study of symbolic logic. I was at university when I first came across set notation and Boolean algebra. Venn diagrams were used in the first lectures to illustrate simple propositions. At that stage some logicians used shaded areas to direct attention to the sets under consideration, others to indicate an empty set.

I am sure John Venn would have been extremely surprised (and delighted) to know that his work, or at least the rudiments of it, was to be included in secondary school mathematics at quite a young age. Of course, it's out of fashion these days as 'modern math' has already been consigned to history.

Wrapper

I'm very glad that Air New Zealand has taken to giving out food on its internal flights. Somehow even the Vege Crisps and coffee that I had on a recent flight made the flight go faster and more enjoyably. But I was surprised to see the table on the back of the crisp packet. Can anyone tell me why I needed to have the division by 10 done for me? Or was it the multiplication by 10 that I was supposed to have found hard?

Populations

Have you recently thought about how big the New Zealand population is? Is it above 4,100,000 or 4,200,000 or 4,300,000 or 4,400,00? Why not get everyone in your class to guess it? Then ask them to go home and find out. Maybe a prize for the closest would be an idea? You might also like to ask them how fast the population is growing. How long does it take for the population to increase by one? You can find the answers to these questions on the Statistics New Zealand web site: http://www.stats.govt.nz/populationclock.htm (and see Afterthought below.)

But what about the population of the USA or indeed of the whole world? Those numbers can be found on http://www.census.gov/main/www/popclock.html. How fast are those populations growing?

How do the statisticians estimate such populations? You can get some idea by reading the web sites. But you might give your students an idea by doing an experiment of your own. Start of by asking them how many children are in your class. For some small classes that may not be too hard. All they have to do is a quick count. Can you count everyone in New Zealand like that? How does a census fit in here? How does that work? Does it count everyone?

Then if you have a reasonably large school you might ask the class how you can count its 'population'. But what about something bigger still – your town or suburb? If you have to do an estimate how would you estimate these populations?

But why is it important to know how many people there are in the town? How does this fit in with resources and planning?

And can you predict when the New Zealand population will get to 4,500,000?

There's probably a lot more that can be done with population data. Reading the Statistics New Zealand web site might give you some ideas.

Solution to March's Endeavour

You were asked:

(a) How many whole numbers between 1 and 100 cannot be expressed as the sum of three or fewer square numbers?

(b) What are the two smallest consecutive whole numbers that cannot be expressed as the sum of three or fewer square numbers?

(c) How many whole numbers less than one million cannot be expressed as the sum of four or fewer square numbers?

These are 'search and find' problems susceptible to efficient 'trial and error', spread sheets and computer programmes. The answers are:

(a) 15
(b) 111, 112
(c) None. Joseph LaGrange (1736-1813) proved that all numbers can be expressed as the sum of four or fewer square numbers.

This Month's Endeavour

Find the smallest number that is the sum of two squares in two different ways.

Solutions to the Month Before Last's Junior Problem

First of all what was the month before last's problem? Remember that I had seen the letters DDSD on a manhole cover on the street and guessed that they stood for 'Dunedin and District Sewerage Department'. So I asked you to find some mathematical 'thing' that DDSD might stand for. It didn't matter whether it made too much sense or not. I was just looking for the funniest or most creative answer.

Last month I got a whole stack of answers from One Tree Point School, Ruakaka. This month Di Christenson's Year 8 class at Golden Bay High School, Takaka got into the act. Here is what came from them.

Kieran Levett	1) Deadly donkey solving division
	2) Dotty dinosaurs subtraction donkeys
	3)dynamite Dude Super Divider
	4) Disco Devil Sometimes Dividing
Shane Hutchinson	1) Dudes do super division
	2)Dotty digital subtraction dudes
	3) Dracula's dudey super division
Benji Wick	1) Dobby Does Subtraction for Dumbledore

Are there any more out there? What about making up your own set of initials and seeing what your students can come up with?

Solutions to Last Month's Junior Problem

First of all what was the problem?

All of you who know Brian Bolt's books will be glad to hear that they are all being reprinted by Cambridge University Press. To celebrate the occasion I'm taking a problem from his Mathematical Activities that was originally published in 1982.

Explain this pattern and show that it is always true

$$3^2 - 2^2 = 5 = 3 + 2$$
$$4^2 - 3^2 = 7 = 4 + 3$$
$$5^2 - 4^2 = 9 = 5 + 4$$

The usual $20 book voucher is available for the best solution to this.

This month there was no correct solution but I have attached a part of Christiane Schicke's email from Germany and a copy of some of their work.

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This month's problem was really hard work for my class. Because we are
still going to learn how to fix our mathematical thoughts on paper
somehow, they continued the pattern orally and wrote it down on the
chalkboard (this was the easy part). Julius then tried to write down the
rules of continuation by himself (see scan).
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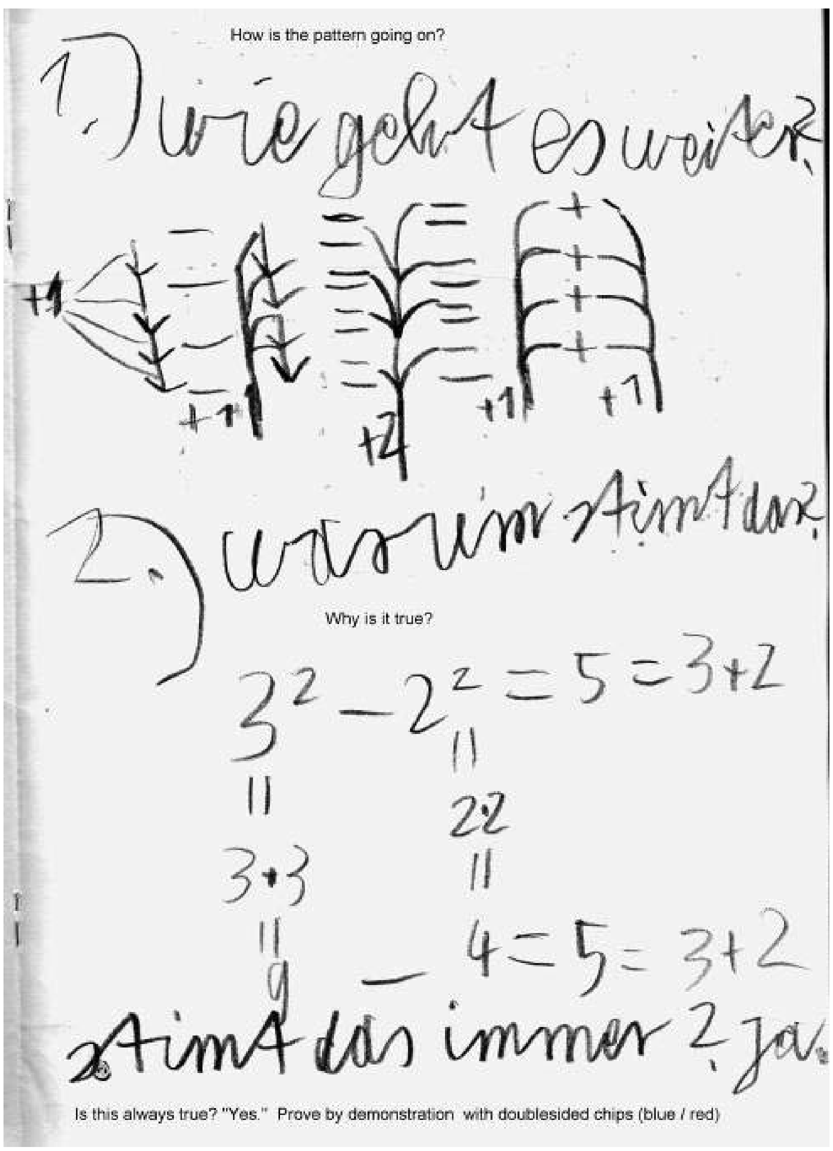

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I am sorry, I can't give you any verbal or abstract algebraic solution,
but Joshua (2nd grader) and Tobias (3rd grader) worked on the problem -
for them, the proof could easily be seen (we are no Montessori school,
but I use the material for demonstration and differentiation).
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I guess I'd better show how it's done. First though, how does the pattern grow? Well' let's take a few big numbers at random. You would expect that

$79^2 – 78^2 = 79 + 78 = 157$, and
$123^2 – 122^2 = 123 + 122 = 245$.

In that case a bit of wording suggests that

A number squared minus one less than that number squared equals the sum of the two numbers.

In algebra this gives

$(n + 1)^2 – n^2 = (n + 1) + n = 2n + 1$.

So how can we prove this? Well, it's all about the difference of two squares.

$6^2 – 5^2$ is actually $(6 – 5)(6 + 5)$. You can see that by multiplying the two brackets out.

$(6 – 5)(6 + 5) = 6 x 6 + 6 x 5 – 5 x 6 – 5 x 5$.

The middle two terms cancel and we get $6^2 – 5^2$.

Now the same thing happens with

$11^2 – 10^2$ because that's the same as $(11 – 10)(11 + 10)$.

But in general,

$(n + 1)^2 – n^2 = [(n + 1) – n][(n + 1) + n] = (n = 1) + n = 2n + 1$.

This Month's Junior Problem

Before I think up this month's problem let me encourage solutions and work samples. Actually I'll just steal another number pattern from Brian Bolt.

Can you continue this pattern, perhaps say what the general pattern is, and give a diagrammatic justification (or any justification for that matter)?

$$1 = 1^2$$
$$1 + 3 = 2^2$$
$$1 + 3 + 5 = 3^2$$
$$1 + 3 + 5 + 7 = 4^2$$
$$1 + 3 + 5 + 7 + 9 = 5^2.$$

Afterthought

The New Zealand population was estimated to be 4,263,268 on Thursday, 27 March 2008 at 6:45:35 p.m.

The U.S. population was 303,717,672 and the World population was 6,659,318,679 at 05:45 GMT (EST+5) on March 27, 2008.