Newsletter No. 58 **October 2006**

Scottish-born E. T. Bell once wrote a book called *Men of Mathematics*. In more politically correct times of course it would have been called *Men and Women of Mathematics* or *People of Mathematics.* Either way, at the time the book was said to be indispensable for the appreciation of much of science, mathematics and philosophy, mathematicians being far less well-known than their scientific counterparts. We often forget, in our algebraic ramblings or geometric fumblings that the whole edifice of mathematics was built by relatively few people. 'Lest we forget' is a much-used phrase in other contexts but applies equally to the writers and strivers of mathematics in earlier times. It is one of the reasons we include regular historic items in the newsletter and our Booke Reviews.

I recently came across a superb resource for those interested in biographies of mathematicians. If you're a student researcher you need go no further that the website of the School of Mathematics and Statistics at the University of St. Andrews, Scotland. Their website address is:

http://www-groups.dcs.st-and.ac.uk/~history/BiogIndex.html

The mathematicians can be accessed alphabetically or by the half-century in which they were born. The website has a section on women mathematicians and biographies are illustrated with portraits or photographs where available. Along with the mathematicians are an index of famous curves, time lines, anniversaries (names of mathematicians who were born or died on each day of the year) and an honours board. This last includes a list of the Fields Medal winners and both the Lucasian and Savilian professorships. Among the mathematicians in the biographical list is that of Jerome Cardan whose autobiography is our Booke Review below. He also provides our quote this month!

> *Some students confer more distinction by their presence than others dishonour by their withdrawal.*
>
> **Jerome Cardan**

The hottest temperature on the planet of 58 degrees Celsius was recorded at Al'Aziziyah in the Sahara Desert. The people of Rome acclaimed Charlemagne Emperor, aka, 'King Father of Europe' when he was 58. On a more sombre note: Charles Dickens, Chet Baker, Gustave Flaubert, Heinrich Kepler, Thomas Moore, Simeon Poisson, Vikdun Quisling, Octavia Butler and Ivor Novello all died aged 58.

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What's new on nzmaths.co.nz

If you are a teacher in a New Zealand school and haven't yet looked at the Learning Objects section of the site it is definitely worth a few minutes (or hours?). This month we have added a new object called "The Fractions of Fractions Tool". It provides a graphical representation to help users visualise how to calculate fractions of fractions. It can be found at http://www.nzmaths.co.nz/LearningObjects/fractions/index.swf and, unlike the other Learning Objects, is openly available to **all** users.

Clerihews

Apparently there is a thing called a "Clerihew". It's a poem like a Limerick only worse. The rules for a Clerihew are that it has four lines; that the first and second lines rhyme as do the third and fourth; and that the lines don't scan. Here we offer three Clerihews for your enjoyment and edification.

> 'I quite realized,' said Columbus
> That the earth was not a rhombus,
> But I'm a little annoyed
> To find it is an oblate spheroid.
>
> Archimedes of Syracuse
> To get into the news
> Called out 'Eureka'
> And became the first known streaker.

Pythagoras of Samos
Became reasonably famous.
His theorem on the square on the hypotenuse
Got a lotta news.

You see too that Clerihews usually contain the name of someone famous. If anyone can make up one or two of these animals we'll gladly print it in the next issue.

Celebrity Quotes

Here are a few quotes that are attributed to famous people. Who said what? The answers are in the Afterthoughts at the end of this newsletter.

A. The good Christian should beware of mathematicians, and all those who make empty prophecies. The danger already exists that the mathematicians have a covenant with the devil to darken the spirit and to confine man in the bonds of Hell.

B. Do not worry about your difficulties in mathematics. I assure you that mine are greater.

C. O King, there is no royal road to Geometry.

D. If, instead of sending the observations of able seamen to able mathematicians on land, the land would send able mathematicians to sea, it would signify much more to the improvement of navigation and the safety of men's lives and estates on that element.

Booke Review

The Book of My Life - Jerome Cardan

This autobiography of a well-known mathematician was written in Latin in 1575. It was translated into Italian in 1821, German in 1914 and English in 1930. Mine is the Dover edition of 1962. A prodigious writer, Cardan wrote about 140 books and 100 manuscripts on a wide range of subjects including mathematics, morals, religion, science, medicine and divination. Few survive. His most famous book the *Ars Magna* contains formulae and principles that still bear his name today.

The Book of My Life was described by biographer Henry Morley in 1854 as a 'garrulous disquisition upon himself written by an old man when his mind was affected by recent sorrow.' Certainly by his own testament, Cardan had his share of sorrow. The book describes his 40 year struggle with poverty, disgrace and ill-health, not to mention the execution of his eldest son for wife-murder. However, it also describes how he became a fashionable and sought-after physician in northern Italy.

The 54 chapters are a rather loose compilation on a range of subjects. In chapter seven, for example, on 'Sports and Exercise', Cardan describes how during the day he walked about wearing sandals reinforced with lead and weighing about eight pounds. In 'Books I Have

Written' we see that his mathematical interests range over studies in proportions, number properties, geometry and algebra. Cardan seems to have had an inferiority complex for in chapter 48 he lists 73 names of 'illustrious men' in whose works he had an 'honourable mention'. The only illustrious name I recognise is Niccolò Tartaglia who, Cardan says, 'spoke evil of me and later, in Milan, was obliged to take it back publicly'. Could this have anything to do with Tartaglia's crabbed response at Cardan's plagiarism of his general solution of the cubic equation? Cardan seems to have done this without malice and it was later writers who dubbed the solution 'Cardan's Rule'.

More on the Vatican and codes

Viète was a fairly famous French mathematician who lived from 1540 to 1603. His fame now is due to the fact that he introduced 'modern' notation into algebra.

But being France's most prominent mathematician, Viète was employed by the French king as his royal code breaker. When France was at war with Spain, Viète was very successful at cracking the secret messages of King Philip II of Spain. Philip, convinced that his secret codes were unbreakable, complained to the Pope that Viète must have used demonic powers, and that he should be arrested. The Pope ignored the complaint. Vatican code breakers had been reading Philip's secret messages for years.

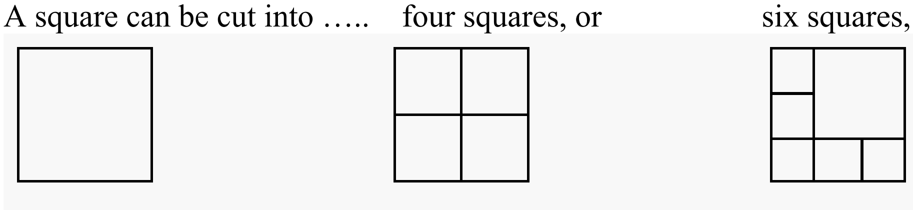
More Nice Numbers

In our solution to August's Junior Problem last month we defined 'nice' numbers. The definition was used to aid the explanation of the solution in the sense that a temporary name was given to a set of numbers to take the place of a long description each time. Sometimes names are used like this to stand for something just while we are working on a problem, similar to the way x is used to take the place of an unknown number. Occasionally, perhaps because a lot of people begin to use it, a name catches on and becomes part of the language – the words matrix and prime are examples.

In a problem that was popular towards the end of last century the term 'nice' numbers was defined differently as follows;

A number n is said to be 'nice' if a square can be subdivided into n non-overlapping squares. Which numbers are nice?

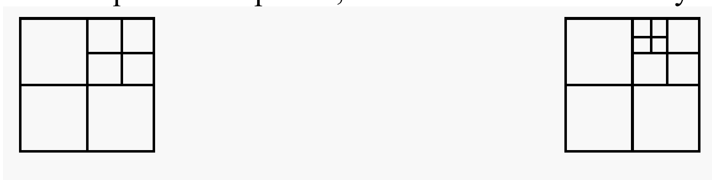
For example:
A square can be cut into ….. four squares, or six squares, or ….



Nobody said the squares had to be the same size!

The question is; into how many squares can we cut our original square? Is it possible to cut it into two squares (with none left over)? How about three squares? Or five squares? Or seven squares? What numbers of squares are possible? What numbers of squares are not possible?

A bit of playing around with paper and scissors may convince you that you can cut the paper square into any number of squares except two, three and five. How can you be absolutely sure?



Well, once we have cut the paper into a particular number of squares we can always obtain three more by simply taking one of the squares and cutting it into four. Four squares can become seven, seven can become ten and so on.

$4 - 1 + 4 = 7$ $\qquad\qquad$ $7 - 1 + 4 = 10$

We have seen that the original square can be cut into six and seven squares, it only remains for us to show it can be cut into eight for all numbers higher than six to be possible. We'll leave that little exercise for you to solve.

Nice numbers are all the positive whole numbers except 2, 3 and 5.

Nursery Rhymes

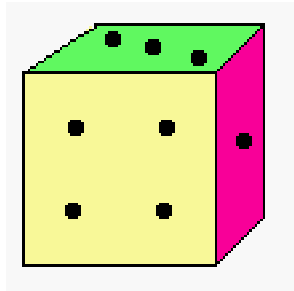
This is for those of you who know about falling bodies and how fast they fall.

Humpty Dumpty sat on a wall.
Humpty Dumpty had a great fall.
The distance he fell, the King's Men declared
Equalled exactly ½ gt^2.

And for those of you who know about π and 22/7.

Little Jack Horner
Sat in a corner
Working out digits of pi.
He sucked on his thumb
And did a quick sum
Then said "Three and one-seventh's too high!"

Solution to September's problem

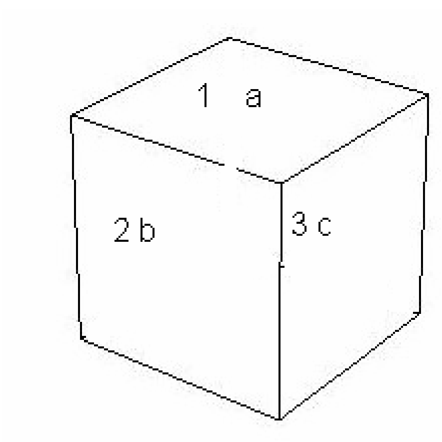


The problem that we're looking to solve this month is: Here's a simple little problem of combinatorics. In how many ways can the numbers 1 to 6 be placed on a regular six-sided die such that the 1 is opposite the 6, the 2 opposite the 5 and the 3 opposite the 4? This isn't one of them!

The winner is Marnie Fornusek of Rotorua. Her solution is printed below.

I think there are only 2 ways the numbers 1 to 6 can be placed on a regular six-sided die such that the 1 is opposite the 6, the 2 opposite the 5 and the 3 opposite the 4.

You only need to look at three faces a, b, c that are next to each other (because the other faces are opposite them and their numbers are determined as per above)



With the 3 numbers, you can get 3! = 6 permutations. Faces (a,b,c) could be (1,2,3), (1, 3,2), (3,1,2), (3,2,1), (2,3,1), (2,1,3).

(1,2,3) can be rotated to give (2,3,1) and (3,1,2) . (1,3,2) can be rotated to give (3,2,1) and (2,1,3) so there are only two different ways that the faces can be arranged.

* * * * * *

Suppose that we change the dice problem a bit. Suppose that we first colour each face of the dice in a different colour. Now, subject to the numbers on opposite faces adding to 7, let's ask in how many different ways the numbers 1 to 6 can be placed on the die?

We'll give you a minute or two to think about that. The answer can be found in Afterthoughts.

This Month's Problem

The digits 1 to 9 have been arranged to fit in a three-by-three square such that the numbers 327, 654 and 981 have a special property; the second is twice the first and the third is three times the first. There are other ways of arranging the nine digits with the same property but only one where the smallest of the three-digit numbers is even. Can you find it?

3	2	7
6	5	4
9	8	1

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 September's Junior Problem

So the problem for which we are looking for solutions is this one: Look at the whole numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, … where we have put the prime numbers in red. Note that the longest string of consecutive composite (non-prime) numbers so far in our list consists of the five numbers 24, 25, 26, 27, and 28. Can you find a string of 10 or more consecutive composite numbers? Is it possible to find a string of 100 or more consecutive composite numbers?

Kieran Liddington of Mount Wellington came up with this correct answer and so wins this month's prize.

199 – 211 is a string of more than 10 composite numbers.

For the next one I have got this answer:

Take any number $n > 1$. Then looking at $a_k = (n+1)! + k + 1$, where k goes from 1 to n, you get:

$a_1 = (n+1)! + 2,$
$a_2 = (n+1)! + 3,$
:
:
$a_n = (n+1)! + n + 1.$

Notice we have n consecutive integers. Notice 2, 3, ..., n+1 all divide (n+1)! So we have n consecutive composite integers.

(Remember that $n! = n \times (n-1) \times (n-2) \times \ldots \times 3 \times 2 \times 1$. So $5! = 4 \times 3 \times 2 \times 1 = 120$.)

This Month's Junior Problem

This section contains a monthly problem competition for students up to Year 8. What's more the usual $20 book voucher is available for the winner. Please send your solutions to derek@nzmaths.co.nz and remember to include a postal address so we can send you the voucher if you are the winner. This month we're asking for you to think logically.

I have a set of cubes.

They are each coloured red or blue and there is at least one of each colour.

They weigh either 1 kg or 2 kg and there is at least one of each weight.

Is it true that there are two cubes that have different colours ***and*** different weights?

Afterthoughts 1

Here's another one of those filtered down funnies:

$$\frac{1}{n}\sin x = ?$$

$$\frac{1}{\cancel{n}}\mathrm{si}\cancel{\mathrm{n}}\, x =$$

$$six = 6$$

Afterthoughts 2

A is clearly a churchman. Probably an early one by the look of the language. How about St. Augustine?

B, ah now I read recently that this person wasn't a slouch in maths at all, not as the uncontrolled hair nor the quote might suggest. This one goes to Einstein.

For C, think ancient, think geometry, think the person who wrote the mathematical textbook book that was used for 2000 years. Think Euclid.

And D looks as if it is from a seaman who wants navigation to be improved. You've got a lot there to choose from but this was one of the early ones and not English. Try Ferdinand Magellan.

Afterthoughts 3

Well, the 1 can be placed on any one of six faces, the 2 on four of those remaining (it may not be placed opposite the 1) and the 3 on two of those remaining (it may not be placed opposite the 1 or 2). We needn't consider the 4, 5 or 6 since their positions are determined by the 1, 2 and 3.

There are then, $6 \times 4 \times 2 = 48$ ways the numbers can be placed according to the conditions.

Afterthoughts 4

We are indebted for some of our copy this week (Clerihews, Nursery Rhymes, Celebrity Quotes, and more on the Vatican and codes) to the South African Mathematical Digest. It can be obtained for R60 plus postage by emailing win@maths.uct.ac.za.