Newsletter No. 46 **August 2005**

Last issue, in our introduction, the word motivation appeared. It's considered a normal part of a teacher's job these days to motivate pupils. Gone are the days when they just did as they were told whether they liked it or not. Today pupils have to be convinced that maths is good for them and that they will enjoy doing it. We don't always succeed but maybe we can occasionally capture their interest for a while.

In these days of open access to computers another approach towards improving motivation occurred to me. When I first meet a class I ask the individuals to fill in a questionnaire about themselves - you can print one out for them or just ask them in class. Besides questions like, 'What do you hope to achieve this year in your study of mathematics?' and 'How do you think maths will help you in your chosen career?' throw in the innocuous, 'What is/are your favourite interest(s) out of school?' Use the answers to this last question later as a pupil project. Get each pupil to check the internet and write about what they find when they couple maths with their chosen interest via the search engine. For example, one interest I encountered was dogs. On searching for maths-dog links the pupil came across the fact that dogs have a concept of cardinality and, surprisingly, they also seem to be able to do simple arithmetic. Another pupil investigated maths-Rap links and discovered the connection between rhythm and learning: how rhythm is and has been used as an aid to memory. The story of Maori Chief Kaumatara who used a hitting stick when reciting from memory his detailed tribal history was quoted and how maths tables done as 'pleasurable rap music' improves speed of memorising.

> *The main sources of mathematical invention seem to be within us rather than outside us: our own inveterate and insatiable curiosity, our constant itching for intellectual adventure.*
>
> **George Sarton**

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What's new on nzmaths.co.nz

We have set up a mailing list for Māori medium teachers of mathematics. Our intention is to use this mailing list to provide updates on additions to the Rauemi Reo and Te Poutama Tau sections of the site, as well as to notify members of other relevant information that might be available. If you would like to subscribe to this mailing list please go to http://list.nzmaths.co.nz/cgi-bin/mailman/listinfo/maori and follow the instructions.

We would also like to take this opportunity to ask that you invite any friends, family, coworkers, or even just casual acquaintances that might be interested in receiving this newsletter to subscribe by going to http://list.nzmaths.co.nz/cgi-bin/mailman/listinfo/newsletter and filling in their information according to the instructions.

Last month we invited users to submit activities to include in the Numeracy Planning Assistant, and had very little response. We would love to be able to share some of the activities used by teachers, so if you have any short numeracy 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

ANZ Maths Week is this month; the fourth week of Term 3, i.e. 15 to 19 August 2005, although activities and competitions started 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 already started. 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/

The First Time for …

This month we go back to the website that gives some of earliest known uses of the words of mathematics. The site can be found at http://members.aol.com/jeff570/i.html. It could well be a good source of a productive hour or so for some of your more able students.

The terms **IMAGINARY** and **REAL** were introduced in French by Rene Descartes (1596-1650) in "La Geometrie" (1637). The site gives this translation of the appropriate extract from that book.

...neither the true roots nor the false are always real; sometimes they are, however, imaginary; namely, whereas we can always imagine as many roots for each equation as I have predicted, there is still not always a quantity which corresponds to each root so imagined. Thus, while we may think of the equation $x^3 - 6xx + 13x - 10 = 0$ as having three roots, yet there is just one real root, which is 2, and the other two, however, increased, diminished, or multiplied them as we just laid down, remain always imaginary (page 380).

It's interesting that Descartes uses x^3 as we do but for some reason uses xx for x^2.

Real numbers are used throughout school whereas Imaginary numbers don't come into their own until students start to solve quadratic equations.

HEPTAGON. *Heptagon* appeared first in English in 1570 in Sir Henry Billingsley's translation of Euclid's *Elements.* In 1551 in *Pathway to Knowledge* Robert Recorde had used the word *septangle.*

HEXAHEDRON. The word "hexahedron" was used by Heron to refer to a cube. This isn't surprising as cubes have six (hex) faces. He used "cube" for what we would call a cuboid – a brick shape.

According to http://www-groups.dcs.st-and.ac.uk/~history/Mathematicians/, Heron of Alexandria lived between about 10 and 75 AD. This site also gives this picture of Heron.

WHOLE NUMBER. Writing in Latin, Fibonacci (of Fibonacci numbers fame: 1, 1, 2, 3, 5, 8, 13, …) used *numerus sanus* for whole number (1, 2, 3, …). Fibonacci lived from 1170 to 1250 AD.

But the first appearance of *whole number* seems to be from about 1430 in *Art of Nombryng*. This quote is given

"Of nombres one is lyneal, ano(th)er superficialle, ano(th)er quadrat, ano(th)cubike or hoole."

Now the interesting thing here is that in this use, *whole number* has the obsolete definition of "a number composed of three prime factors".

However, *whole number* is found in its modern sense in the title of one of the earliest and most popular arithmetics in the English language, which appeared in 1537 at St. Albans. The work is anonymous, and its long title runs as follows: "An Introduction for to lerne to reken with the Pen and with the Counters, after the true cast of arismetyke or awgrym in hole numbers, and also in broken".

We're not sure what 'broken' numbers are but maybe they are ones with fractional parts.

And just to show that not all words that are vaguely mathematical are ancient try this one. The term **BYTE** was coined in 1956 by Dr. Werner Buchholz of IBM. A question-and-answer session at an ACM conference on the history of programming languages included this exchange:

JOHN GOODENOUGH: You mentioned that the term "byte" is used in JOVIAL. Where did the term come from?
JULES SCHWARTZ (inventor of JOVIAL): As I recall, the AN/FSQ-31, a totally different computer than the 709, was byte oriented. I don't recall for sure, but I'm reasonably certain the description of that computer included the word "byte," and we used it.
FRED BROOKS: May I speak to that? Werner Buchholz coined the word as part of the definition of STRETCH, and the AN/FSQ-31 picked it up from STRETCH, but Werner is very definitely the author of that word.
SCHWARTZ: That's right. Thank you.

Is that enlightening? Maybe not but you might win a bet with it.

Curriculum Reference Group

The last meeting of the maths group that's working on the maths curriculum met in Wellington on June 20. There were three main items on the agenda. These were yet another look at the Essence Statement; a look at the latest draft of the curriculum statement; and the second tier material.

Essence Statement: Each learning area will have an Essence Statement. The aim of these is to give some general idea of what each learning area is and say what its special features are. To get some commonality of form into the Essence Statements, they are to be written under the following headings: definition; application; aims; and strands. The latest draft of the Maths and Stats Essence Statement follows.

MATHEMATICS AND STATISTICS

DEFINITION

Mathematics is the exploration and use of patterns and relationships in quantities, space and time, and statistics is the exploration and use of patterns and relationships in data. They are connected yet different ways of thinking and problem solving.

APPLICATION

Mathematics and statistics have a broad range of practical applications to everyday life. Both disciplines provide students with powerful ways of thinking that help them to explain, interpret, investigate, and make sense of the world in which they live. Mathematical and statistical models are created to represent and predict real life situations and imaginary contexts. Displays and symbols are used to find and communicate patterns and relationships. Mathematics and statistics provide useful tools and ways of thinking to other essential learning areas and for many vocations.

AIMS

We teach mathematics and statistics so that students develop the ability to think creatively, critically, strategically and logically, to structure and organise, to carry out procedures flexibly and with accuracy, to process and communicate information, and to have a positive disposition for intellectual challenge.

Mathematics and statistics also help students to develop other important thinking skills, including the ability to create models and predict outcomes, to conjecture, justify and verify, to seek patterns and generalisations, to estimate with reasonableness and calculate with precision, and to infer with an appreciation of variation.

STRANDS

The following strands categorise the intended outcomes. It is critical that students make sense of, and see connections within and between, these strands.

Mathematics: Number and algebra

Number is about calculating and estimating through the use of appropriate mental, written, or calculator methods, approximation, and alertness to the reasonableness of results. Algebra is about generalisation and representation of patterns and relationships through symbols, graphs, and diagrams.

Mathematics: Geometry and measurement

Geometry is about recognising and using the properties and symmetries of shapes, and describing position and movement. Measurement is about quantifying the attributes of objects through the use of appropriate units and instruments, and the prediction and calculation of rates of change.

Statistics

> Statistics is about looking for and explaining differences and variability in data, and how much confidence can be placed on any conclusions drawn from it. Statistics also involves the collection of data in consistent, reliable and unbiased ways.

Draft curriculum: It's important to realise that the achievement objectives of all of the learning areas will be published in one volume. This means that the details of each will be necessarily occupy less room than the present document Maths in the New Zealand Curriculum. At the moment the Maths and Stats achievement objectives fit on 8 pages, one for each level. Levels 1 to 6 inclusive have three columns, one for each of the strands (see Essence Statement above). Levels 7 and 8 have just two strand-columns, one for Maths and one for Stats. Each strand is further divided into sub-strands.

Below we show how each strand is sub-divided.

Number and Algebra strand

  Levels 1 to 4: number strategies; number knowledge; equations and expressions; patterns and relationships
  Levels 5 and 6: number strategies; equations and expressions; patterns and relationships

Geometry and Measurement strand

  Levels 1 to 6: measurement; shape and space; position and orientation; transformation

Statistics strand

  Levels 1 to 6: statistical investigation; statistical literacy; probability

At Level 7 and 8 the strands become

Mathematics

  patterns and relationships; equations and expressions; calculus

Statistics

  statistical investigation; statistical literacy; probability

A great deal of thought has been given to the statistics and there is probably more change planned in this area than anywhere else. On the other hand, those of you at level 1 to 4 especially, who are now familiar with the Numeracy Project, will find a lot of old friends.

Second tier: Because of the précis-like nature of the draft curriculum, a far more extensive, second tier, collection of material is being produced. This will go into much more detail and give a better idea of what the curriculum plans to do.

The second tier drafts that are currently being produced run under the headings achievement objectives; exemplars of student performance; important teaching ideas (working at); important teaching ideas (working towards); and useful resources.

Where to look for more information: All of the material that is being produced for the new curriculum will be made available on the curriculum project online web site (click on the Curriculum Project Online shell on the nzmaths Home Page). If you have any comments or queries please email Derek Holton on derek@nzmaths.co.nz or send them via the web site.

Solution to July's problem

You were given two cubes with integral sides having their total volume numerically equal to the difference in their surface areas and were asked for the sizes of the cubes.

Suppose the larger cube has side x units and the smaller cube side y units, then,

$$x^3 + y^3 = 6x^2 - 6y^2$$

factorising, $$(x + y)(x^2 - xy + y^2) = 6(x + y)(x - y)$$

dividing by $(x + y)$, $$x^2 - xy + y^2 = 6(x - y)$$

rearranging and factorising $$y^2 = (6 - x)(x - y)$$

Now, $y^2 > 0$ and $x > y$, so therefore $x < 6$. Since x is integral and the length of the side of a cube, we may try x = 2, 3, 4 and 5 and determine the value of y in each case. Only x = 4 gives an integral value for y which is 2.

Hence the sides of the cubes are 2 and 4 units. Although trial and error may give the solution fairly quickly, the above method shows that the solution is unique.

This month's winner is Paige Whitaker from Columba College in Dunedin.

Incidentally, these two cubes also have the sum of their volumes numerically equal to the sum of the lengths of their edges. You might like to check that.

This Month's Problem

What is the smallest whole number that when you change any one of its digits to <u>any</u> other the result is not prime? For example, the number is not 27 since you can replace the 2 by 3 giving 37 which is prime. Similarly, the number is not 54 since you can replace the 4 by 9 giving 59 which is prime

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.

Last Month's Junior Problem

The best solution to last month's junior problem was sent in by William Plunkett of Waitaki Valley School, a book voucher is on its way to you William. Here is the problem followed by a solution.

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 multiple of 10 from … onwards. What is the magic number that's missing from the last sentence?

By experimenting you can see that you can make 40, 50 80, 90, 100, 120, 130, 140, 150, … But once you get to 150, you can see that you have four 'tens' in a row. So you can get the next four by just adding 40 to this first string. In other words, 160 = 120 + 40, 170 = 130 + 40, 180 = 140 + 40, 190 = 150 + 40. And adding 40 to each of these you can get the next four consecutive 'tens'. And adding 40 to these you can get the next four, and so on. So (provided the Post Office has enough stamps!), Prunella can make any amount form $1.20 onwards.

This Month's Junior Problem

In order to get a few more entries this month, we'll move away from the Post Office. This month we'll give a $20 voucher for a solution by a student up to Year 8 to this problem.

Twenty rectangular tiles are laid out in the 4 by 5 array shown below.

Now 8 of the tiles are red and the rest are blue. What percentage of the tiles are blue?