NZ MATHS
new zealand maths
www.nzmaths.co.nz

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Sitting in the garden recently, as one is inclined to do on a warm sunny day, two boys passed on their way home from school and I heard one say proudly, “You know what? I’m in the top 48 per cent for my age in New Zealand.” I didn’t catch the rest so don’t know to what the comment referred. It probably had something to do with one of the curriculum related competitions that have proliferated in secondary schools since the Australian Mathematics Competition was first held in 1978.

Anyway, it got me thinking about how poorly averages and proportions are understood generally. For example, an Australian Minister of Labour was once quoted as saying, “We look forward to the day when everyone will receive more than the average wage.” On National Radio’s Morning Report I once heard the illuminating remark that, “It weighed less than average but it must be remembered that the average was higher than usual” and it was our own canteen lady who asked, “Which half do you want, the bigger half or the smaller half?” We all love Bill Cosby’s, “If at first you don’t succeed, you’re just about average” but can we forgive an engineer who, on hearing that the Accident Compensation levy had trebled, said, “We can’t sustain this 300 per cent increase”?

I have a couple of favourites. First E. Grebenik’s, “The overwhelming majority of people have more than the average number of legs” (think about it!) and Paul Harvey’s, “If there is a 50-50 chance that something will go wrong, then nine times out of ten it will”…

… And it did in last month’s newsletter. Many thanks for the feedback to the newsletters. It’s always welcome especially when it helps us improve things. In that respect it seems my linguistic research last issue left something to be desired and so,

Nga mihi nui o te tau hou.

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WHAT'S NEW ON NZMATHS SITE

Home Page
We have redesigned the home-page of nzmaths to allow for the addition of the two new components: Rauemi Reo Māori and Numeracy Projects. The jigsaw pieces which have been developed to Level 6 are displayed as having more depth than those which include material for Levels 1-4. The jigsaw piece for the Rauemi Reo Māori is "flat" which reflects the fact that this component is still being developed. As material is added to each component its depth in the home-page graphic will increase. We hope that you like the new Home Page.

Māori Translations
The problems at Level 1 and 2 of the Problem Solving section of the site, have been retranslated and were transferred to the site during the last month. The Level 3 to 6 problems are in the process of being retranslated and will be available soon. Once they are completed our translator will work on completing translations for all the problems.

DIARY DATES

MERGA 25
The annual conference of the Mathematics Education Research Group of Australasia (is scheduled for July 7-10, 2002 at Auckland University. The 2002 MERGA conference will provide opportunities for mathematics teachers, educators and curriculum developers to contribute and listen to research presentations and be actively involved in workshops,symposia and special interest groups developed around the conference theme of Mathematics Education in the South Pacific. For further details look on the conference website: www.math.auckland.ac.nz/MERGA25

*** And don't forget Maths Week during the second full week of August – start planning now!

The Problem Challenge Competition
At the end of last year the mathematics problem-solving competition Problem Challenge finished its eleventh successful year. The competition is principally aimed at pupils in years 7 and 8, though some children from year 6 also participate. Problem Challenge has proved to be popular and has grown from 210 schools entering 5,000 children in 1991 to about 720 schools entering some 40,000 children last year.

The format of Problem Challenge is quite simple. Each year entrants attempt 5 problem sets that are spaced out about a month apart beginning in April. Each set contains 5 questions and entrants have 30 minutes to complete them. (Examples can be viewed on-line: see the end of this article.) Problem Challenge is generally pitched at above average children in years 7 and 8 and very able children in year 6. However, in reality children with a wide range of abilities enter the competition, so the first problem or two on each set are usually relatively straightforward in order that all children entered can have some success. Other problems are harder and challenge the very able.

The competition relies heavily on help from each school in the form of one or more administrators who carry out the marking of each set, in accordance with provided answers and solutions, and keep track of overall marks for each entrant.

At the end of the competition all the results are collated and certificates and awards are sent out to the schools that have taken part. Last year, as in recent years, those in about the top 10% received a certificate of excellence, those in the next 30% a certificate of merit and the remainder a certificate of participation. In fact certificates of excellence went to those who (out of the 25 problems) correctly answered at least 14 from year 6, 17 from year 7 and 20 from year 8. Book token awards are made to the top 1.5% or so of entrants. Included in that category in 2001 were the 58 year 8 students, 14 year 7 and 4 year 6 students from around the country who remarkably managed a perfect score of 25 correct out of 25, a feat further recognised by a special certificate.

The competition is organised by John Curran and John Shanks from the University of Otago’s Department of Mathematics and Statistics. The problems themselves vary considerably in content and difficulty. Each year the problem setters try to come up with something fresh and interesting. Some are "original", some are modified versions of standard questions, and the remainder involve ideas freely borrowed from other sources. One of the hardest aspects of problem setting is finding an appropriate balance between clarity and verbosity. Often a concisely phrased question has to be lengthened to ensure all assumptions are clearly mentioned but then risks being too wordy and off-putting to some entrants.

Over the years, while it was recognised that the competition provided a wide spread of results, the increasing participation has meant that there were significant numbers of entrants gaining very high marks. Therefore the organisers decided that a more demanding competition could be instigated to try to separate out the very best students in a more exam-like setting. As a consequence, in 1999 the Final Challenge was introduced. This is offered to students who have done particularly well in Problem Challenge during the year and is held in mid-November using a 20-question multiple-choice one-hour format with marking carried out by the organisers. In 2001 over 1600 students from 190 schools took part and prize winners were awarded over $1300 in total. The Final Challenge is designed to be tough, with the later questions being very demanding. Nevertheless we have been surprised each year that there are children who can not only cope with these problems but also gain perfect or near perfect scores. There are certainly some very able problem solvers out there, who may, one likes to think, be the mathematicians of the future.

Two books of collected questions have been compiled; these provide invaluable problem-solving resources for all teachers at this level, whether or not their students participate in the competition. The first book features the 125 questions from the first five years of Problem Challenge together with their answers, solutions, and extension material. The second features the 100 questions from the following four years together with the 20 questions from the Final Challenge held in 1999. Teachers can use these problems flexibly as a resource for pupils from years 6 to 10, and to support the mathematical processes strand from Mathematics in the New Zealand Curriculum. Although the problems are principally aimed at intermediate level children, they should provide an excellent challenge for year 6 pupils with a special aptitude in mathematics.

This year Problem Challenge has made it to the internet. We have a home page at http://www.maths.otago.ac.nz/~pc, from where you can find further details of the competition, see examples of sets from 2001, access an analysis of results and a list of the Final Challenge winners from 2001, and discover how to order the books mentioned above.

Happy problem solving!

LARGE NUMBERS

Many people have difficulty visualising large numbers. How many of us know what a million grains of sand look like, or a million people? Generally, we are poor at accurately estimating how many items are in a collection if the collection is large - estimating accurately takes practice. This leads to a serious problem. When calculating with large numbers we are never sure whether we have the correct answer. The answers are not always intuitively obvious. People such as bankers and astronomers who work with large numbers have to check their arithmetic very carefully.

You might like to see how accurate you are at estimating the following numbers or alternatively you might like to try them out on your pupils. Try to decide quickly giving the answer which you think is closest to the correct one.

1. The number of 40 cent stamps needed to cover a square metre.
   a. 100 b. 500 c. 1,500 d. 15,000 e. 150,000

2. The number of different arrangements of the letters of SOUTHLAND.
   a. 400,000 b. 400 c. 40,000 d. 4,000 e. 40

3. The sum of all the whole numbers from 1 to 100.
   a. 500 b. 5 million c. 50,000 d. 500,000 e. 5,000

4. The number finger widths in a kilometre.
   a. 7,000 b. 70,000 c. 700,000 d. 700 e. 7 million

5. The number of seconds in a day.
   a. 9,000 b. 900 c. 90,000 d. 900,000 e. 9 million

6. The number of cubic millimetres in a cubic metre.
   a. 10,000 b. 1 million c. 100 million d. 1 thousand million
   e. 1 million million

7. The length of the equator in kilometres.
   a. 400 b. 4,000 c. 40,000 d. 400,000 e. 4 million

8. The distance from the earth to the moon in kilometres.
   a. 400 b. 4,000 c. 40,000 d. 400,000 e. 4 million

[Answers at the end]

By the way, did you know that the number of ways you can arrange 30 desks in a classroom is more than the number of drops of water in all the oceans, seas and rivers of the world (even if the whole globe was water!)?

FEBRUARY SOLUTION

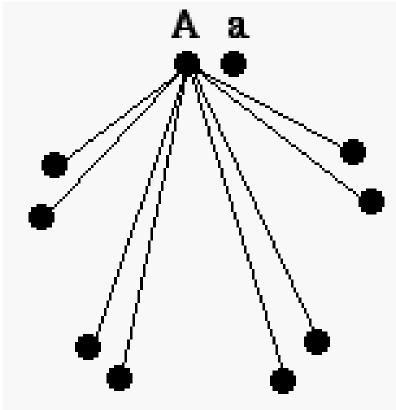
You were given the following problem to solve:

My wife and I recently attended a party at which there were four other married couples. Various handshakes took place. Of course, no-one shook hands with himself (or herself) or with his (or her) spouse and no-one shook hands with the same person more than once.

After all the handshakes were over I asked each person, including my wife, how many hands he (or she) had shaken. To my surprise each gave a different answer. How many hands did my wife shake?

At first there seems to be insufficient information to solve this problem but with one of Konig's graphs to help it becomes easier. Imagine the ten people as five pairs of dots, each pair representing a husband and wife.

Each of the other nine people, excluding myself, shakes a different number of hands so, since no-one shakes his own or his partner's hand, their answers must range from 0 to 8. Imagine one person, **A**, shaking eight hands, as indicated by the lines connecting **A** with other people. Since everyone, except **A**'s partner **a**, shakes at least one hand, **a** must have answered 0. Why can't either my wife or I be **A**? Choosing another person to shake 7 hands it can similarly be shown that their partner must shake 1 hand.



The pattern continues leading to the only possible solution, that my wife shook four hands.

PROBLEM OF THE MONTH

Logic problems are always popular. Not only do you come across them in newspapers and magazines but bookshops are full of collections of them. Here's an original one which may take your fancy - that's if you're into water sports!

Three boating couples live on yachts. Each yacht has a dinghy tied to the stern. Alan and Barbara's yacht is neither Seahorse nor the (different) one with a yellow dinghy. The blue dinghy is tied to the yacht called Foxy. Sam is proud of his silver dinghy. Sarah does not live on Tuku. Brian and Kiri enjoy jazz (don't we all).

Who is married to whom? On what yacht does each couple live? What colour dinghy does each have?

[Answers to 'Large Numbers' above: 1c, 2a, 3e, 4b, 5c, 6d, 7c, 8d]