

Newsletter No. 16

August 2002

Hi there, welcome to the August edition of the newsletter. I was reading about Galileo recently and it set me wondering if many of us have used the history of maths in our teaching. Perhaps we have used historical anecdotes to give a more human touch to mathematics. Maybe, for example, we've mentioned that Archimedes used mirrors to set fire to attacking Roman ships – a well-known story that first appeared in histories some centuries after Archimedes' death and is probably untrue. We might have mentioned to a class that Pythagoras was the leader of a secret society which had as one of its tenets 'don't eat beans'. Then there was Evariste Galois who wrote an important maths textbook on the eve of his death by duel. Such stories give context to mathematics and can be an important aid in capturing the interest of students. Some teachers may have even gone further and described some of the techniques used by earlier mathematicians and how they relate to those of today.

If you think aspects of the history of mathematics might enliven your classroom here's a few websites for you to explore:

- <u>www.webexpert.net/vasilios/GRscnce.html</u>
 The website consists of about 150 links on the history of Greek Science.
- <u>www.mcs.drexel.edu/~crorres/Archimedes/contents.html</u> The website is a comprehensive collection of Archimedian miscellanea.
- <u>http://www.members.aol.com/bbyars1/algebra.html</u>
 The website contains a brief description of early Babylonian arithmetic, Euclidean geometry, the beginnings of Greek trigonometry and an introduction to algebra by the Arabs.

'To get involved in the same processes and problems as the ancient mathematicians and to effect solutions in the face of the same difficulties they faced is the best way to gain appreciation of the intelligence and ingenuity of the scholars of early times.'

Lucas N. H. Bunt

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What's new on the nzmaths site this month?

This month we have opened the online facilitation section of the Numeracy Projects area of the site. This is a password protected area which is currently only available to the schools that have been selected for the pilot distance version of the Numeracy Project.

We have also added 10 new links to the site.

Diary Dates

Maths Week runs from the 12th to the 16th of August so there's still time to get organised. For more information contact <u>www.nzamt.org.nz</u>

Pi in the sky

Following on from our editorial above, about how some history of mathematics might enliven maths classrooms, a look at π can be fruitful. Since the value of π can never be known exactly various approximations have been used over the centuries. Determining their percentage errors can give some insight into problems of practical mathematics as applied to engineering and science. For example, what error is there going to be in the time of swing of a metre long pendulum if π is taken as 3.1? Or, what would the percentage error be in the area of a circle of radius 10cm if π was taken as 3?

Here are a few approximations of π that have been used by various people in the past. Perhaps your students would like to determine their percentage errors (which is good practice in using decimals, calculators and rounding).

The Babylonians	c.2000 BCE	3 ¹ / ₈
Ahmes papyrus	c. 1650 BCE	$4 \times (^{8}/_{9})^{2}$
Old Testament	(I Kings vii 23)	3
Archimedes	287 BCE	$3^{10}/_{71} < \pi < 3^{1}/_{71}$
Ptolemy	160 CE	3 ¹⁷ / ₁₂₀
Fibonacci	1200 CE	3 ³⁹ / ₂₇₅
Siddhantas	380 CE	$3^{177}/_{1250}$
Brahmagupta	620 CE	√10
Chinese	5 th century	3 ¹⁶ / ₁₁₃

I've also come across $\sqrt{2} + \sqrt{3}$ being used as an approximation of π but am not sure of its derivation.

Another look at June's problem

We had three discs with numbers printed on one side. They were known to be 5, 8 and 11, as shown. Numbers were also printed on the reverse sides.



When the discs were tossed in the air it was found, 'after a while', that the sums of the numbers showing when they landed were consecutive. We were required to find the numbers on the reverse sides of the discs. A couple of newsletter readers soon discovered that there was more than one solution to the problem and in the July issue we asked you to find all the solutions.

First it must be said that this is a statistical problem, in the sense that in theory the conditions may not be met. For example, it is possible for the sum 24 to keep appearing if the discs were to land 5, 8 and 11 'for a while'. Of course, the probability of this happening is extremely small! It is assumed in the problem, therefore, that the discs are thrown enough times to show all the possible outcomes (of which there are eight, not necessarily all different, sums).

Now, suppose 5, 8 and 11 were the numbers tossed and that their sum 24 was the highest possible with the discs available. Then since there are a maximum of eight possible sums the lowest must be 17 giving the eight consecutive sums from 17 to 24 inclusive.

Similarly, if 5, 8 and 11 were tossed and gave the lowest possible sum, then the highest must be 31 giving the eight consecutive sums from 24 to 31.

These two outcomes are possible as are all possible batches of eight consecutive sums between them.

For example, if 1 is on the reverse of the 5, 7 on the reverse of 8 and 9 on the reverse of 11, as shown,



the possible consecutive sums range from 17 to 24.

Similarly, discs numbered



give consecutive sums ranging from 18 to 25.

The solutions are not unique since the discs



also give consecutive sums ranging from 17 to 24.

As an additional thought, as was implied above less than eight consecutive sums may be obtained. For example,



gives consecutive sums ranging from 21 to 24.

In summary, there is a lot in this problem!! We have had some correspondence about it but due to personal circumstances will have to deal with that in the September newsletter.

Solution to July's problem

Since each person buys as many calves as he gives dollars for one, the total amount each pays is a square number. We are therefore looking for three pairs of square numbers in which the members of each pair differ by 63.

Search-and-find, or a more mathematical approach, will give the pairs (64, 1), (144, 81) and (1024, 961). These are the amounts that each person pays for their calves in father-son pairings and hence the <u>number</u> of calves they buy in the same pairings are (8, 1), (12, 9) and (32, 31).

Now we know that Alan (a father) buys 23 calves more than Ernie (a son) and Craig (a father) buys 11 more than Dan (a son). From these bits of information we can identify the father-son pairings.

Bob is the father of Dan, Alan the father of Fred and Craig the father of Ernie.

Again, as we mentioned above, due to personal circumstances correspondence on the disc and this problem will have to be dealt with in our next newsletter. Thanks for writing and if you'd like to tackle another problem, this one about the currently topical subject of soccer, read on

This Month's Problem



Last season a total of 40 teams competed in our local two soccer divisions. In each division each team played one match against each other team. Two points were awarded for a win and one for a draw (no points were awarded for a loss). During the season there were 156 more matches played in one division than the other.

Action United, which only lost two matches all season, gained 20 points. How many of Action United's matches were drawn?

Each month we give a petrol voucher to one of the correct entries. Please send your solutions to <u>derek@nzmaths.co.nz</u> and remember to include a postal address so we can send the voucher if you are the winner.

Enjoy your maths teaching and remember what Herman Hankel wrote:

In most sciences one generation tears down what another has built on. In mathematics alone, each generation builds a new story to the old structure.



Maths Week 2002

12th to 16th August 2002

This is a time when Mathematics is highlighted and celebrated in school communities throughout New Zealand. The importance of maths is noted and fun maths – based activities are enjoyed.

Maths Week has three key messages:

- 1. Maths is used by everyone
- 2. Maths is an important part of everyday life
- 3. Learning maths can be an enjoyable and rewarding activity.

We realise schools and teachers are extremely busy so have tried to provide a variety of resources to help. The resources come in two forms: the printed material and a Maths Week web site.

The Printed Material consists of posters and newsletters and were sent to all New Zealand schools late week one of Term 3. They are in English and te reo Maori.

The web site contains problems, activities, and games for teachers to use, competitions for students, and information for parents. The popular Maths Week Survivor Series has been repeated along with a new Mathematics Investigation Challenge. The material is in English and te reo Mäori.

Visit our web site and win!

www.mathsweek.org.nz

Daily Challenges are problems, activities and games teachers can select from and use during Maths Week. Some challenges are suitable for the whole class, some for small groups of students working cooperatively and some for individuals. The Challenges are organized into five levels from Early Childhood through to senior secondary and will be available from 1 August 2002.

Maths Week Survivor Series

Each day of Maths Week codes and clues are placed onto the web site. Classes decipher the codes and solve the clues. Information is gathered throughout the week leading to treasure being found on Friday. The class needs to work together and cooperate to survive the week.

There are three series. Series One is a reasonably straightforward challenge aimed at Year 4 to Year 7 classes, Series Two is a harder and more complex challenge aimed at Year 6 to Year 10 classes and 'Kimihia te Ora' is in te reo Mäori aimed at Year 4 to Year 8 classes.

Teachers need to register their class or classes for this series. Classes surviving the week will go into a prize draw and receive a certificate acknowledging their survival skills.

Comments from teachers involved in Maths Week Survivor Series 2001:

"The treasure hunt was superb. This whole event had the school buzzing for a week. Everyone, teachers and pupils, were talking about the clues and how to solve them."

"My class took part in the Maths Week Survivor Series last year and absolutely loved it. It became a great collaborative task and students were always eager to get the next part of the puzzle to complete it. They enjoyed the hunt during our last session."

"It was definitely a great way to get the students motivated with mathematics."

"It was an awesome week."

"There was a real buzz in Maths that week."

"Even the staff looked forward to receiving their next clue."

"It was really easy to manage, the children were really interested in it and they thoroughly enjoyed it."

The New Zealand Mathematics Investigation Challenge

This is a new competition where individuals and groups of two or three students investigate one of the four topics, present their findings and submit it for judging.

The topics for 2002 are: **"2002 equals . . . "** Students send in interesting equations that equal 2002, e.g. 1000+1000+1+1=2002



"The Best – The XVII Commonwealth Games, Manchester 2002"

Students decide on who, from the XVII Commonwealth Games, is "The Best" and present a clear explanation, with relevant information, to justify their decision. Possibilities are: best performance, best improvement, best athlete, best country, best team, best incident, best moment, etc.

"Palindrome / Reflection Investigation"

Students are to investigate an aspect of palindromes or reflection or both. They are to submit an informative and interesting presentation either summarising what they have found out or present a piece of work. Art work that is based on reflection is acceptable for this topic.

An Essay – "Maths and Sport"

An essay on the topic of "Maths and Sport"

Entries need to be in Palmerston North by Tuesday, 13 August 2002. This deadline means the investigations need to be started before Maths Week as Tuesday, 13 August is the Tuesday of Maths Week, week 5 of Term 3

For more information e-mail: <u>i.stevens@inspire.net.nz</u>

All the best for Maths Week.

Ian Stevens



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