Newsletter No. 60 **February 2007**

Welcome to another year and to the 60th edition of the newsletter. I thought it might be a good idea to show you what we wrote to begin our first ever newsletter in 2001. Here it is:

BECAUSE:

- it's more fun that way;
- it leads to better learning;
- it gives you a better idea of what maths is all about; and
- it's the way that research mathematicians do it

we take a problem solving approach to the lessons. It's our basic philosophy of maths education and so all our material is based around a problem or an activity of some kind.

Hello everyone. From this month this year we are running a monthly newsletter to go with this web site. If you have registered for this newsletter it will be automatically emailed to you each month. In the newsletter we plan to have

- information regarding the site and its development;
- specific comments about different problems and units;
- discussions on various aspects of the learning and teaching of mathematics;
- your general comments and queries;
- hopefully, answers, comments and ideas from your students; and
- anything else that seems to be important to the teaching, learning and understanding of mathematics generally.

This means that we would like to have your contributions. Email us now (our email addresses are a little further on). What is troubling you? What would you find useful? How can we help you? How can you help us? None of this necessarily has to do with the site itself. So long as it's to do with maths, then we're interested and we think that other teachers will be too.

Since 2001 our philosophy hasn't changed, so read on and enjoy. But we do note that it's been hard to get you to send us your general comments and queries. We're sure that this newsletter will be much more interesting if we have comments from you. So please send something to derek@nzmaths.co.nz and he'll make sure that it gets into the system.

Or maybe your students have a question that they would like to put to us. They can try the same route.

So for our first newsletter in 2007, we continue with a look at the number 60 - it is our 60th issue after all.

It is the smallest number that can be divided by 1, 2, 3, 4, 5 and 6. The Babylonians used a base 60 arithmetical system for mathematical and astronomical work some of which lingers on today. For example: there are 60 minutes in a degree, 60 seconds in a minute and similar arrangements for time. The interior angle of an equilateral triangle is 60 degrees. 60 is also a 'highly composite' number as defined by Ramanujan. Such a number, counting from 1, sets a record for the number of its divisors. The first few highly composite numbers are: 1, 2, 4, 6, 12, 24, 36, 48, 60 and 120. You might also know that the Peace Bell displayed in the foyer of the United Nations building in New York was forged in Japan from coins of 60 countries. On the usual more sombre note Thomas Barnardo, Geoffrey Chaucer, Calvin Coolidge, Gary Cooper, George V, Sir William Hamilton, Herodotus, David Livingstone, Paul Klee, Theodore Roosevelt and Leon Trotsky all died at the age of 60.

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What's new on nzmaths.co.nz

Over the last couple of months we have added several new units to the site. We now have 14 units of work linked specifically to the learning objects in the Digistore. Most of them can be found on this page:
http://www.nzmaths.co.nz/Number/Operatingwithno.aspx

Teachers involved in the Secondary Numeracy Project should keep an eye on their section of the site (http://www.nzmaths.co.nz/Numeracy/SNP/SNP.aspx) as this collection of resources is being updated reasonably regularly. We now have 27 sets of activities, with about as many more to be added in 2007.

Summer Reading

Because my life has a reasonable amount to do with mathematics and because p is a mathematical symbol, someone in my family felt sure that “Life of Pi” by Yann Martel (republished by Canongate, 2006, and winner of the Man Booker Prize, 2002) was the book for me this Christmas. It turned out that Pi had very little to do with p and even less to do with mathematics. And at the third way mark I was beginning to think that this book was ***not*** the book for me this Christmas nor perhaps any other time and whether I wouldn’t be better sleeping in the sunshine than reading this book, even though where I was at the time there was little sunshine to sleep in. But then the ship sank, Richard Parker made his appearance, and suddenly things changed dramatically for the worse. Well worse for our hero but better for me.

The hero is named Piscine Molitor Patel. There is no way that you can possibly guess why proud parents could have come up with that name. Well, there was no choice with Patel. That’s clearly an Indian surname. And ‘piscine’ is French for ‘swimming pool’. What’s more, Piscine Molitor was one of the best swimming pools in Paris until it was finally closed in 1997.Why an Indian couple, even one who ran a little zoo, would want to call their son after a Parisian art deco swimming pool you’ll have to read the book (or a better review than this one) to find out. (It may be slightly easier to understand when you realise a fact that I hadn’t known, that part of India had strong connections to France at one point.) But you may be able to imagine why a boy with that name should be continually embarrassed by his peers and want to have it unofficially shortened to Pi, which is infinitely more to be desired than other possible shortenings.

So it has only taken me two paragraphs to explain the title of the book. This book is Pi’s life.

On the other hand, I won’t go into the genealogical details of Richard Parker. That is also a long story but one that reveals far more than you deserve to know right now. The revelation of those details I have to leave in Yann’s hands because this is at the heart of why at page 103 of 319, I suddenly realised that though Pi had nothing to do with maths, it wasn’t even short for Pythagoras for crying out loud, this was a book for me and reading on was something that was more important to me than sunshine or coming to tea when I was called.

Incidentally that often happened to me when I was young and was being totally absorbed by a book. My parents and grandmother were often annoyed by the fact that I would ignore the call to eat preferring the pleasures of the book than the pleasures of the food. I was too young at that point to have to choose between any other pleasures. Back then I think that my concentration was such that I didn’t actually hear them calling, though they didn’t believe it.

There is no doubt a lot of interesting pieces of religion are scattered throughout this book but I think the claim that you can’t read this book and not believe in God is not true and has got nothing to do with why I was entranced by the second two hundred pages or so. The fascination for me was in trying to understand how Pi and Richard could possibly live together in a lifeboat. (I don't think that I would have made it with Richard for more than a day.) The constant dance between them held me spellbound to the end and I can't tell you how the situation was finally resolved. You'll have to read the book for that.

My main worry now is was Pi a real person?

Folding Sheets and Other Problems

As you can see we're starting off 2007 in a gentle way. Here are three problems that might get you going without too much fuss. The first one isn't even a maths problem. It's just the result of long-term frustration on my part.

The fitted sheet problem: How do you neatly fold a fitted bed sheet? I've been trying to do this for years now but I've had no success. Every time I put them away they look awful. I can do a fair job on my own with rectangular sheets but fitted sheets … With my wife I can do a little better, at least at the start, by first folding each of the two short corners together. But even then, at the next step things deteriorate and we still end up just rolling it around itself. Can they be folded neatly? Or is the only thing to do to put it straight onto the bed off the line?

Crossing the road: This morning a lady and I were waiting for a car to come so that we could both cross the road. I could clearly walk at one and a half times the speed that she could manage but she could get across before the car and I couldn't. How could that be? (Assume that we both started together.)

Where to park? Dunedin has parking meters that serve a row of parking spots along the edge of the road. After you feed the meters you take a ticket and display it in your car, so you have to walk from the car to the meter and back to the car. Which parking spot should you choose in order to minimise the distance that you have to walk during the day?

The solutions to the last two we will guarantee to be in the next newsletter. However we hope to hear from you on the sheet conundrum. We'll also publish your answers to the other two too.

More Golfing

You may remember a year or so ago; in fact exactly a year ago, we included an article on golf. More precisely the article was about organising 20 players into groups of 4, so that everyone played 5 times and in each group of 4 no one ever played with someone that they had already played with.

Well my same correspondent came back with 24 players who each wanted to play in 6 rounds, 4 players to a group. The 20 player problem I knocked off pretty smartly so I tackled the second with a great deal of confidence. But it turned out to be significantly more difficult. I guess there is just something about 24 that is not as nice, in this context, as 20. So I had to call on some international experts in the area and they produced the answer for me. In fact they were able to show that it is possible to organise ***seven*** rounds. And here they are:

1	13	20	24
2	19	23	15
3	22	14	21
7	10	16	5
8	11	17	6
9	12	18	4

1	16	23	6
2	22	5	18
3	4	17	24
10	13	19	8
11	14	20	9
12	15	21	7

1	19	5	9
2	4	8	21
3	7	20	6
13	16	22	11
14	17	23	12
15	18	24	10

1	22	8	12
2	7	11	24
3	10	23	9
16	19	4	14
17	20	5	15
18	21	6	13

1	4	11	15
2	10	14	6
3	13	5	12
19	22	7	17
20	23	8	18
21	24	9	16

1	7	14	18
2	13	17	9
3	16	8	15
22	4	10	20
23	5	11	21
24	6	12	19

1	10	17	21
2	16	20	12
3	19	11	18
4	7	13	23
5	8	14	24
6	9	15	22

Now maths is all about generalisations so if you have nothing else to do this month you might like to see what you can manage with 28 players and rounds of 4 players who don't ever play in the same foursome with anyone twice.

Booke Review

Todhunter's Plane Trigonometry - Isaac Todhunter, 1882

This book follows on from our last issue where we reviewed *Todhunter's Algebra*. This particular work contains 'all the propositions which are usually included in treatises on plane trigonometry' of the time, together with about a thousand examples for exercise. (It must be remembered that mathematics is not a contact sport and requires lots of practice.) The book is designed for secondary students and requires fluency with algebra and arithmetic.

Chapter one lays down definitions of angles measured in degrees, grades and radians and the six trig functions as well as two others that are not used today. By page 70 the book has covered all the trigonometry met by students studying the subject up to Form 7 level today. From there on, until the conclusion on page 340, it gets really heavy!

After a chapter on how to construct trig tables and one on the theory of logarithms, Todhunter launches into a treatment of series - the log series, exponential and later the trig series. It is assumed that readers have a knowledge of the binomial theorem. (This is not now officially part of the school curriculum.) Interspersed with these are sections on use of the semi-perimeter formulae which older readers may remember from their school days, more complicated problems using the sine and cosine formulae and the inverse trig formulae. De Moivre's theorem is not forgotten.

Much of the content was already not being taught in the 1950s, things like Euler's Series and those ascribed to Machin and Gregory, for example. The book is a fascinating window on what was expected of students preparing for university in the late 19th century, at any rate, those intending to study the sciences. My copy of the book has been annotated with worked calculations on many of the blank pages and corners of pages. It is interesting to note that in some cases these are worked to 16 places of decimals!! How things have changed!

Solution to November's problem

You may remember from November last year that Colin needed six litres of light grey paint that was to be mixed in the ratio of two parts of white to one part of black. Unfortunately instead he mixed two litres of white paint to four litres of black. What should he do to waste as little paint as possible?

Colin, then, has six litres of paint consisting of four litres of black and two of white that we can call BBBBWW. He should throw away half of this leaving BBW and top up with three litres of white. The wastage is then only three litres.

Probably due to the summer recess we had no answers to this problem.

Problem of the Month

In 1884 E. A. Abbott, a London clergyman and headmaster who wrote several scholarly books, published a satirical novel *Flatland* (it has since been republished by Dover). It is about characters that live in a two-dimensional universe. The narrator is a square who has an eye at each corner. The rigid class society of Flatland is made up of individuals polygonal in shape. The greater the number of sides of the polygon the higher up the social ladder it is. The story is of little interest to mathematicians but later workings of the theme fascinate in their glimpses of possible science and technology of the two-dimensional world. One of the most intriguing extensions of the idea was written 100 years later by computer technologist K. Dewdney (*The Planiverse*, 1984, Poseidon Press) who designed two-dimensional machines that in theory would work, if such a universe could exist. This month's problem is set in a flat land, i.e. a two-dimensional universe, although it may not be THE Flatland. It is, in fact, called the Field.

Ted was a sophisticated right triangle (*see below for explanation of terminology) from the Field who enjoyed travel. One day he decided to mount an exploration into some of the more wild parts of the plane*. Suitably provisioned he set off into the relative unknown. On the very first day he met a primitive* right triangle called Duz.

Now I should explain, that when triangles meet it is usual for them to exchange lengths of shortest sides, only in the most intimate of relationships would the lengths of all sides be exchanged. Ted and Duz were both surprised to hear that their smallest sides were 12. Sophisticated Ted knew at once that he held a strong advantage since he was able to work out the lengths of Duz's other sides. Are you sophisticated? Can you do the same? What are the lengths of Duz's longer sides?

*A right triangle is what we call a right-angled triangle. All triangles in plane Field have sides with whole number lengths. A plane is a two-dimensional planet. Field is the name of the plane on which Ted and Duz live. A primitive right triangle is one in which all three sides have no common factor.

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.

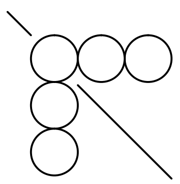
Solution to November's Junior Problem

In November we asked if you could put the numbers 1, 2, 3, 4, 5 into the configuration of circles below so that each circle had a different number and so that the numbers in the horizontal circles add to the same number as the sum of the numbers in the three vertical circles.

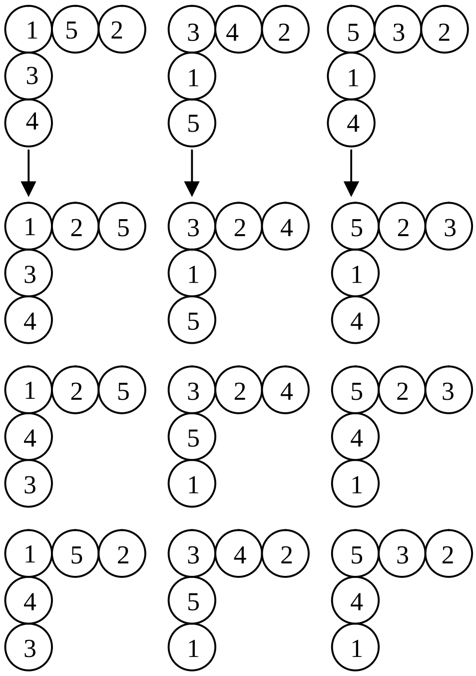
O O O
O
O

We got the following answer from Michael Catterall and that deserves this month's prize. Congratulations Michael.

There are 12 combinations you can make, if you do not count the combinations produced using symmetry:



Although in reality there are only 3 *different* combinations, (listed on the next page), which can be rearranged 3 times, (also shown below) to produce different combinations of the one original combination.



Just to complete that, we note that only the totals 8, 9, 10 can appear on each side. This is because 1 has to be somewhere and the biggest total that it can appear in is 1 + 5 + 4 = 10. What's more 5 has to appear somewhere and the smallest total it can appear in is 5 + 1 + 2 = 8.

Now 8, 9 and 10 can only be made up using three of the numbers 1, 2, 3, 4, 5 in exactly two ways. (You can see these in the diagram above.) So that's why we get only three really different arrangements.

You might like to see if there is some pattern to the sets of five different numbers that can also be put in the circles so that the horizontal and vertical sums are the same. Can you make any other problems from November's problem?

This Month's Junior Problem

This section contains a monthly problem competition for students up to Year 8 with a $20 book voucher available for the winner. Please send your solutions to derek@nzmaths.co.nz and remember to include a postal address so that we can send you the voucher if you are the winner.

Now a 2-digit number is something like 54 which uses two digits; a 3-digit number is something like 547 which uses three digits; a 4-digit number is something like 5470 which uses four digits, and so on.

How many 4-digit numbers are there which use only odd digits (i.e., the numbers 1, 3, 5, 7 and 9)? Can you explain how you got that number?