

## Winter Weekend Experience 2011

I have recently returned from the M500 Winter Weekend and what a delightful experience it was to be sure. Grateful thanks are due to Diana, who womanfully organised the whole event, and Rob and Judith, who managed to keep us happy and occupied for 48 hours. Not to mention Tony Huntington who pottered around with his camera and notebook, checking out what was going on.

When I arrived on Friday afternoon I found a bunch of friends whom I see once a year, sitting in comfortable armchairs, chatting and gossiping, and occasionally mentioning mathematics. As my formal mathematical training ceased some thirty years ago, and I have practised very little since then, I was delighted to avoid plunging into differential equations and imaginary numbers. That evening Rob persuaded us to form teams and he conducted a quiz. My normal bedtime is 10.00, but I had to stay up until after midnight just to see how it all ended. The extensive, geographical, historical and cultural knowledge, especially of films and pop groups, of our competitors meant that our team was not among the first three.

We slept in comfortable study bedrooms and I was impressed with the quality of the food at lunch and dinner, especially the salads. Breakfast left something to be desired, but with a refrigerator in my room I decided to take my own orange juice and coffee next year.

We started on Saturday with some jolly good 'O' level stuff – considering Euclid's axioms, definitions, postulates and proofs. We drew triangles, looked at pictures of triangles and played with plastic triangles that we could click together (at this point I thoroughly enjoyed regressing to four years' old). We constructed proofs and I won a prize for standing up and declaiming my proof which turned out to be spectacularly fallible. We considered how the angles of a triangle might not add up to 180 degrees. We looked at triangle numbers (1,3,6,10 ...) and played with plastic cubes to form triangles. We proved Pythagoras' theorem and failed to prove Fermat's last theorem. We considered Pascal's triangle and how it relates to the sum of triangle numbers. We found a relationship between triangle numbers and square numbers, and fitted together our plastic-cube-triangles to make squares. I remembered that I knew not only the symbols for sum and square root but (with a bit of help from my friends) the meaning of 'mathematical progression', 'recursive relationship' and 'f'.

After a good lunch we settled down to primes and squares. We saw that 13 is the sum of two squares, 4 and 9. We listed the primes up to 100 and separated them into those that were the sum of two squares and those that were not. We looked for patterns, discussed with our friends, experimented and found some interesting results. We used prime factorisation to find the HCP and LCM of two numbers. We moved on to prove that the root of a prime number is irrational and considered Goldbach's conjecture, that 'every even number is the sum of two primes'. It is unproven, and remains so despite our best efforts. Finally we were encouraged to write poems about our experience. My favourite was:

Roses are red  
Violets are blue  
There's one even prime  
And it's two.

Later on we considered polygons and found that only three regular polygons tessellate the plane. We developed our thoughts into three dimensions, with the help of yet more plastic triangles and cubes. We experimented, conjectured, convinced and proved to our hearts' delight. We considered another approach, using faces, edges and vertices, and found that  $f+v-2=e$ .

Rob and Judith realised that by Saturday evening we could do with a break, and sat us down to watch Andrew Wiles discussing his proving of Fermat's last theorem. We moved into supper reassured by the thought that it was indeed more difficult than Pythagoras' theorem, and it wasn't surprising that we had failed to prove it before lunch.

We spent Sunday morning investigating rotten tomatoes, and their rates of decay, depending upon the container in which they were stored. Finally, Rob discussed the most beautiful equation. He took us through some work with functions, imaginary numbers, sines and cosines, and I remembered that I had indeed come across the Taylor and MacLauren series in a former life. He elegantly proved, to our satisfaction, that  $e$  to the ipi equals minus one (I'm afraid my computer won't allow me to put in the appropriate mathematical symbols).

During the weekend we had some singing, and we played some jolly games. We found that the total number of gifts over the twelve days of Christmas was 364, and we were impressed by the true love's generosity, and the coincidence of the number being one fewer than the days of the (non-leap) year. We shook hands with a number of friends a number of times and analysed our results. We sang an interesting version of supercalifragilisticexpialidocious, where the third and fourth lines of the chorus were:

We in mathematics have a far superior chorus  
NewtonRaphsonEuclidPascalGaussandPythagorus

Before we bade farewell Tony Huntington made a short presentation of his experience of the weekend, the results of his quizzing others, and some suggestions for the future.

I should like to encourage anyone with mathematical knowledge from 'O' Level to postgraduate to try the winter weekend. There's something there for everyone: good food, good singing, good friendship and stimulating brainwork.

And many thanks again to Diana, Rob, Judith and Tony.

Judith Furner