BBC NEWS

The beauty of maths

A POINT OF VIEW
By Lisa Jardine

The story of an Indian clerk with an extraordinary talent for mathematics should inspire young people to see the beauty that lies in numbers.

I have been thinking recently about the way in which stories we are told when we are young shape our adult lives.

I am reading with great enjoyment a new novel entitled The Indian Clerk, by David Leavitt, based on the life of the early twentieth-century Indian mathematician Srinivasa Ramanujan.

I picked it up because I have such intense memories of my father telling me Ramanujan's story, at about the time I started secondary school, shortly after I had won a scholarship to a famous girls' school on the strength of my own mathematical promise. I even had a black-and-white photograph of Ramanujan, looking sultry and faintly like Elvis Presley, on the table at home at which I did my homework.

A humble clerk at the Port Trust in Madras, Ramanujan first came to the attention of European mathematicians in 1913, when he wrote a ten-page letter to the Cambridge mathematician and fellow of Trinity College, GH Hardy, which contained over 100 statements of theorems on infinite series and number theory.

Number theory is a fascinating field of mathematics. It consists of the study of the properties of whole numbers or integers. Among these, primes or prime numbers hold a special charm for number theorists, because of their peculiar power among the naturally occurring numbers.

A prime number is a number divisible only by itself and the number one (which is itself a prime, but for reasons I won't go into here is usually omitted from the list). The primes under 20 are two, three, five, seven, 11, 13, 17, and 19.

After that, primes occur increasingly far apart, sporadically and apparently unpredictably. For centuries, a great deal of mathematical effort has been expended on trying - unsuccessfully - to predict some patterned way in which large primes occur.

Let me try to give you something of the flavour of the way in which prime numbers seem intriguing to someone with a passion for numbers in general.

Genius

Take the number two. Two is the smallest prime number. It is also the unique prime which is even, because all even numbers are divisible by two and any number apart from two which is divisible by two is not a prime, by definition.

So mathematicians refer to two, the only "even" prime, as the "oddest" prime.

Hardy was immediately intrigued by the extraordinary nature and complexity of the mathematics in Ramanujan's letter. But he was torn between believing that his correspondent was a crank, and wanting to recognise him as a natural mathematical genius.

Having worked through some of the material in the letter with his fellow-mathematician and collaborator J E Littlewood, however, both men became convinced of Ramanujan's unusual ability and, after some initial difficulties, Hardy contrived to get him to Cambridge.

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There followed an extremely productive five-year collaboration between Ramanujan and Hardy. The two perfectly complemented one another's abilities: Hardy was a great exponent of rigour in analysis, while Ramanujan arrived at his results by what Hardy described as "a process of mingled argument, intuition, and induction, of which he was entirely unable to give any coherent account".

Through his work in Cambridge, Ramanujan achieved the recognition he had sought when he first approached Hardy, and in 1918 he was elected a Fellow of the Royal Society (the first Indian to be so honoured).

The British climate, however, took its toll on his health. In 1917 he collapsed with a mysterious stomach complaint and was rushed into hospital, where doctors feared for his life. By late 1918 his health had slightly improved and in 1919 he returned to India. But his health failed again, and he died the following year at the age of 32.

As a child, I found the whole story of the brilliant, self-taught Indian clerk who solved some of the most difficult problems in number theory and died so young, extremely romantic. But it was one specific anecdote about Ramanujan that particularly captivated me.

Ramanujan was recovering from his first bout of serious illness in a nursing home in Putney and Hardy had gone there by taxi to visit him.

Terror

Hardy (never much of a conversationalist) greeted the sick man abruptly with the words: "The number of the taxi-cab that brought me here was 1729. It seemed to me rather a dull number."

To which Ramanujan replied without hesitation: "Not at all, Hardy! It is a very interesting number. It is the smallest number expressible as the sum of two cubes in two different ways."

1729 can indeed be represented as $1^3 + 12^3$ and as $9^3 + 10^3$, and is the lowest integer for which such a combination is possible.

What intrigued me about the story was that someone could have such a familiarity with the integers that he would spontaneously recognise an attribute of an apparently "dull" or unprepossessing number as being susceptible of expression in a (for a mathematician) attractively patterned way.

"Every positive integer is one of Ramanujan's personal friends" was how Hardy's friend Littlewood described it.

Caring deeply about numbers and their properties may in part at least be something that runs in families. At the age of four, my eldest son used to wake in terror from a recurrent nightmare. He was on a wide sandy beach at low tide.

"I had to count the grains of sand," he would tell me, tearfully, "and I knew that I just wouldn't be able to do it."

Even at that age, numbers mattered to him intensely enough for him to dream about them. But just as in some families, fear of spiders is passed on to the children who witness their parents' alarm at an arachnid in the bath tub, so terror of mathematics can be passed on from generation to generation.

The role of good maths teachers in schools to encourage pupils in this area, is particularly important, to overcome openly-displayed anxiety on the part of parents about dealing with maths homework.

Alarming

Last Monday the Royal Society published a "state of the nation" report on the UK's science and mathematics teaching workforce.

The report concluded that there is a crisis in the provision of qualified specialist maths and science teachers in our schools, of which the government is largely unaware.

This shortage is particularly alarming, the report goes on, because "the skills, knowledge and understanding that come from learning and enjoying science and mathematics at school and college prepare young people for jobs in a demanding workplace and life in the modern world".

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The shortage of well-qualified and committed teachers in maths has, I suggest, a particularly unfortunate effect in girls' schools, where it amplifies an existing inclination among many girls to insist that they simply do not like doing maths.

A London inner-city girls secondary school of which I am a governor recently received a dazzling Ofsted report for its achievement across the board. The only area in which there was even a hint of criticism was in maths teaching at key stage four.

When a small group of us discussed the inspection report in detail with the head teacher, she was quick to explain that the problem was a rapid turnover in teachers and serious difficulty in recruiting well-qualified maths teachers at all.

But several people round the table inevitably also mentioned the likelihood that girls simply did not feel comfortable with maths, or even, could not do maths. It was not surprising, was it, if the school had difficulty getting all of them to succeed when it came to numbers and equations?

Thinking back to my own upbringing I feel sure that the problem lies elsewhere. All too often I watch my adult friends back away from a simple arithmetical calculation with the words "I never could do maths".

This is not an excuse they would dream of making publicly with regard to reading.

Perhaps, just as we try so hard to instil a love of great writers in successive generations, we should be looking for more stories like that of Ramanujan, to inspire all our young people with a lasting love for the beauty of numbers.

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