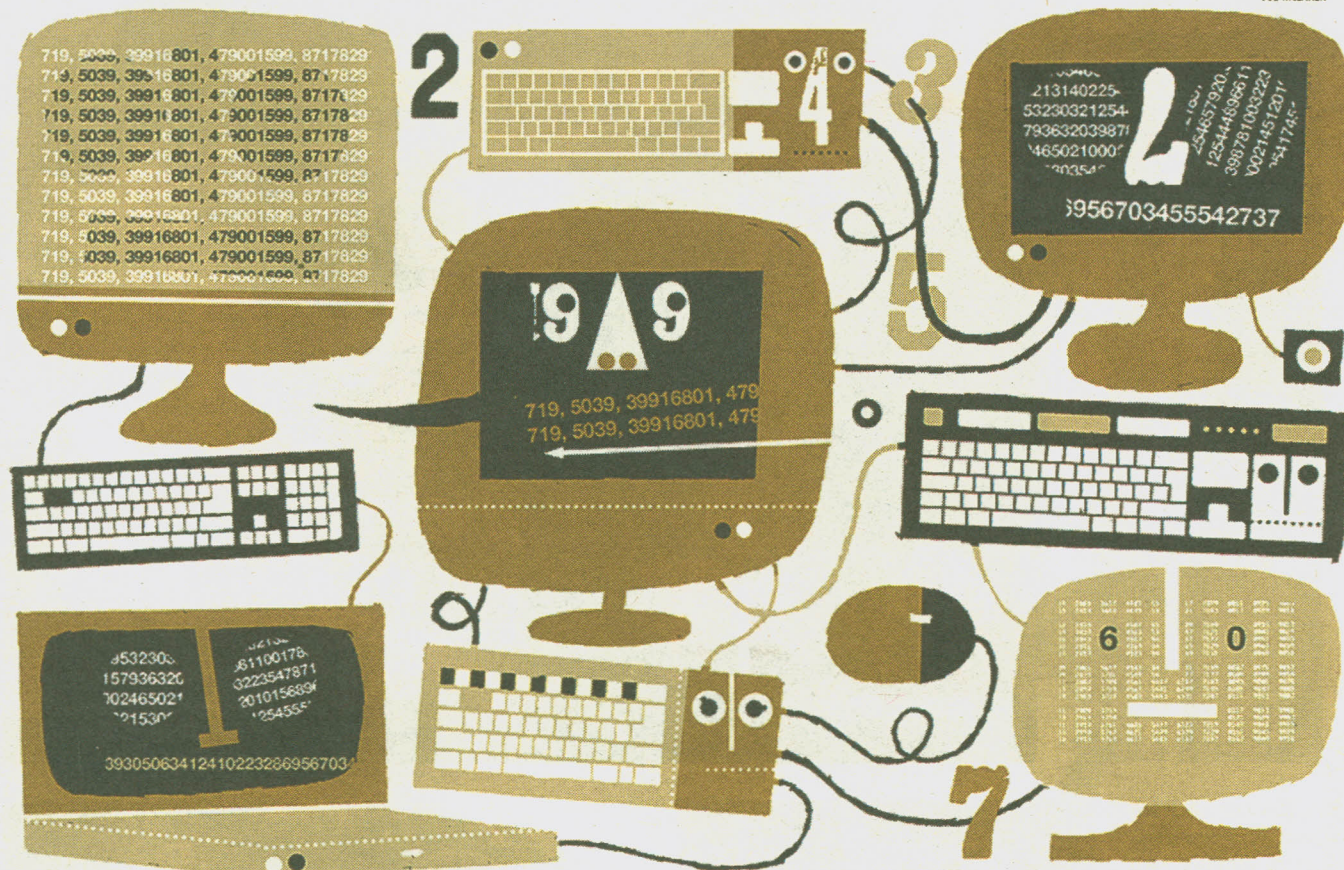


sexy maths

JOE MCLAREN



Primes of passion

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Mathematics is the language of Nature. It helps us to predict climate change, chart the night sky and navigate the inner workings of the atom.

The technology we take for granted — mobile phones, the internet, iPods — wouldn't exist without mathematicians.

In this new column I will explore the human side of maths — how it helps you to choose the best partner, to avoid being caught faking your tax return and to smash terrorist cells. Today, though, I start with one of the great enigmas in maths: those numbers that can be divided only by themselves and 1, the primes.

The French composer Messiaen used them to create a sense of timelessness in his music. David Beckham always likes to play in a prime number shirt. Even the security of the internet rests on the mathematics of these indivisible numbers.

Each website has a public code number which is used to encode credit-card numbers. To decode these secret messages a hacker must find the two primes that are multiplied together to give the website's public code number. Unsurprisingly, the websites are using numbers with several hundred digits that are virtually impossible to crack into primes.

Such is our obsession with prime numbers that one organisation, the Electronic Frontier Foundation, offered a prize of \$100,000 for whoever discovered the first prime number with more than ten million digits.

I remember as a nerdy kid cutting out newspaper reports of a new big prime discovery. In those days, huge supercomputers claimed the glory but one of the exciting things about the hunt now is that anyone with access to a PC can play the

amateur mathematics sleuth simply by downloading a piece of software on to his or her desktop.

I'm not sure if it is my obsession with primes that has rubbed off on my kids, or the prospect of winning thousands of dollars last week, but they were checking a number with 10,853,354 digits to see if it was prime when Edson Smith at UCLA pipped them to the prize with the figure 2 to the power of 43,112,609 -1. Just to give you a sense of how big this number

is, it would take you more than two months to read aloud its 12,978,189 digits. It takes a number with only 80 digits to describe the number of atoms in the universe.

To be honest, though, the news of this new prime is not the buzz in mathematics common rooms. The Ancient Greeks proved 2,000 years ago that there are an infinite number of primes, so we know there are primes with as many digits as you want. The trouble is finding them.

When you look at a list of primes there seems to be no pattern to help you to predict where to find the next big prime. In 1859, the German mathematician Bernhard Riemann came up with a hypothesis about the logic underlying prime numbers that academics have failed to prove for nearly 150 years, despite a \$1 million incentive.

While Riemann continues to give me my fair share of sleepless nights, my kids have now set their targets on a different challenge: finding a prime with 100 million digits. There's a \$150,000 carrot but I've told them not to get too excited about their prospects. Current estimates are that it will take a desktop computer three years with the current software, and there is only a 1-in-200,000 chance that they'll strike lucky.

But then, who does mathematics for money? ●

MARCUS DU SAUTOY

The author is Professor of Mathematics at Wadham College, Oxford. His new television series The Story of Maths starts on BBC Four on Monday at 9pm. To join the search for big primes go to www.gimps.org



THE CONUNDRUM

Mathematicians were not the first to search for large prime numbers. Primes seem to have been discovered by a curious cicada that lives in the forests of North America. The cicadas have a strange lifecycle. These insects hide underground doing nothing for 17 years. Then for six weeks they emerge into the forest to mate, lay eggs and then die. The next generation of cicadas waits another 17 years before they emerge. The question is, why?

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