

Math professor figures kid can make pi history

Canadian's guide will allow calculations to 100-billionth digit

BY STEPHEN STRAUSS
Science Reporter

If you are willing to give up doing anything else on your home computer for a few days, Canadian and U.S. mathematicians have figured out techniques for you to make pi history.

"I predict some smart kid working on a home computer will use these methods to compute the 100-billionth digit of pi in the very near future," said Peter Borwein, a mathematician at Simon Fraser University in Burnaby, B.C.

Pi, as you may remember, is the never-ending number that is produced when the length of the circumference of a circle is divided by its diameter.

Conventionally it is abbreviated as 3.14, but mathematicians have continually stretched the actual number out toward infinity. For example, Dr. Borwein and his brother Jonathan, who also teaches at SFU, recently collaborated with a Japanese colleague to set a pi world record. After 56 hours, the Japanese computer calculated pi to the 4,294,967,286th decimal place.

If printed in a line, the number would stretch out more than 7,000 kilometres. "But this in a sense represents an oldish story," Peter Borwein said. Their Japanese colleague "is just doing more because he has a larger machine."

In a new vein, what he, SFU colleague Simon Plouffe and David Bailey of the U.S. National Aeronautics and Space Administration have been able to do is come up with an algorithm that allows them to arrive at a final number for pi, even

Breaking the pi barrier

In order to calculate pi on your computer, you need this equation and to consult Peter Borwein's World Wide Web page on the Internet. His address is <http://www.cecm.sfu.ca/~pborwein/> and look under the link "Computing Pi and Related Matters."

$$\pi = \sum_{n=0}^{\infty} \frac{16^{-n}}{8n+1} \left(\frac{4}{8n+1} - \frac{2}{8n+4} - \frac{1}{8n+5} - \frac{1}{8n+6} \right)$$

when they haven't computed all the numbers in between. For example, they know that pi to the 40-billionth place ends in the number 1.

"We don't know or see what's in between," Dr. Borwein said.

While it took the trio a day's operating time on a large computer to arrive at the 40-billionth integer, Dr. Borwein believes that, by following some mathematical shortcuts the group has developed, all a mathematically inclined non-professional would need is an off-the-shelf personal computer to calculate a final number for pi that stretched into the billions.

And to help them get there, Dr. Borwein has published a guide on how to use the group's new pi-searching techniques on his Internet World Wide Web page.

What's the use of pushing pi toward infinity?

The computation of pi and other large numbers is regularly used by computer companies to test whether flaws have crept into calculating capacities.

"I can't think of a single one of our large calculations which hasn't discovered some bug in the computer's hardware or software," Dr. Borwein said, adding that the same has proved

true with his and his brother's pi world record.

There may also be a more theoretical use for the computer formula that skips the in-between numbers. "Clearly, while the four-billionth calculation of pi is not a cure for cancer or anything else, it's at least hopeful that we have added some insight to how you prove by it [pi] is a normal number [its digits exhibit no pattern]," he said.

How is it that two brothers end up as mathematicians delving into the mystery of pi? It helps to have a mathematician father who taught at the University of Western Ontario, Dr. Borwein said. "Our father clearly loved his job. When you watched someone get up at 2 in the morning to work, or duck out of a party to go to work, you could see the enthusiasm. But it was a very soft sell, if any at all," he said.

Their mother was a professor of anatomy at Western, Dr. Borwein said, but running a laboratory was "much more like being a middle-sized business person. The nice thing about mathematical research, when you are actually doing it, is that you get to go for a long walk and think. It's mostly in your brain."