Summer math fun at UVM

BY TIM JOHNSON • FREE PRESS STAFF WRITER • JUNE 26, 2008

Toward the end of his presentation Tuesday, in which he stood at a whiteboard regaling his listeners with one box of numbers after another, Jeff Dinitz offered a consoling thought:

Even one of the greatest mathematicians of all could be ... flat-out wrong.

Dinitz, professor of mathematics at the University of Vermont, was talking about Leonhart Euler, an 18th-century European who was not only one of the greatest, but one of the most prolific. Among his many contributions were several unproved propositions called conjectures -- one of which turned out to be the centerpiece of Dinitz's talk.

Dinitz's main audience comprised 32 Vermont secondary-school students -- 16 boys, 16 girls -- who were midway through their third day in the Governor's Institute in Mathematical Sciences, a weeklong exploration featuring games, puzzles and disquisitions from professors on everything from fractals to robotics. Student participants were chosen based on a combination of test results and recommendations, but they also had to apply, meaning they had to like the idea of spending a summer-vacation week learning about math.

Being in a crowd that likes math is a novel experience for many, who are more used to fellow students who see math as a form of drudgery.

"It's great to be around people who are similar," said Stuart Guertin, 14, of Middlebury, who is here for the second time. "There are people I can look up to and learn from."

"We're all here to learn math," said Kevin Wang, 14, of South Burlington. "It's great everybody is so enthusiastic."

On the other hand, considering that some of these students are genuine whizzes, being in their midst can seem daunting at times. Among the institute's alumni are Colin Sandon of Essex and David Rolnick of Rupert, both of whom recently placed near the top in the U.S. Mathematical Olympiad.

"You can be really good at math at your school," said Stephanie Thomas, 16, of the Lyndon Institute, "but when you come here, you don't feel as smart. I'm OK with it."

This math camp was co-founded in 1993 by Tony Trono, a retired math teacher at Burlington High School, and Ken Gross, a UVM faculty member.

Trono, who was to lead a session on problem-solving techniques after Dinitz's discourse on "Latin squares," said the week's offerings have grown to include some of the relatively new fields of math, such as chaos theory and complex networks -- areas most students are unlikely to encounter in high school. At the outset of the week, the students were handed a list of 75 problems, and everyone had to pick one to solve, publicly, this evening.

The week isn't all study. Wednesday, they were scheduled to go to the beach. Dinitz recalled that one year, when the math camp was the same week as a soccer camp, the math group beat the soccer players in a game of basketball.

"They're not only good at math," Dinitz said.

ALISON REDLICH, Free Press

Jeff Dinitz, a professor in the University of Vermont department of mathematics and statistics, lectures Tuesday on Latin squares to 32 high school students from around the state who are participating in the Governor's Institute in Mathematical Sciences.

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A Latin square is a grid -- 2 by 2, 3 by 3, and so on -- in which each number or symbol can appear just once in every row and just once in every column. (Sudoku, anyone?)

Here's an example of a 4 by 4 Latin square:
0 1 2 3
1 2 3 0
2 3 0 1
3 0 1 2

You can swap rows or columns, and it's still a Latin square -- still, in effect, the same Latin square. How many different Latin squares can you make? There's only one other that's 4 by 4, Dinitz said. When you get to 7 by 7, there are 563 arrangements, and after that, there is what Dinitz called "a combinatorial explosion": for an 8 by 8, 1,676,267 Latin squares.

Dinitz remarked in passing that someone had found the number recently for 10 by 10. That's on the order of 500 quadrillion.

As a specialist in combinatorial design -- a field of mathematics that concerns itself with finite sets -- Dinitz spends a good deal of time thinking about such things.

"I get paid to put numbers in boxes," he told the group.

Dinitz's talk, which led his listeners on a brief foray into modular arithmetic, opened with a reference to the renowned Euler (pronounced "oiler") and closed with one of the great one's great mistakes.

Euler was born in Basel, Switzerland, and spent a good part of his life in St. Petersburg, Russia. The story goes that around 1779, the ruler (that would have been Catherine the Great) called on him to come up with a unique marching order. The challenge was this: Given six ranks of officers, and six regiments, arrange 36 officers in six rows and six columns so that each row and column has only one of each rank and one of each regiment.

Another way to think of this challenge, Dinitz said, is to look for two different 6 by 6 Latin squares that, when put on top of one another, would yield 36 distinct pairs of numbers.

Can't be done, Euler surmised. Not only that, he believed, it couldn't be done for squares on the order of 10, 14, 18, and so on, every four. That was Euler's conjecture, but he didn't prove it, and for years it remained one of mathematics' famously unsolved problems.

In about 1900, well before computers, someone went to the trouble of running through all the 6 by 6 combinations and showing that, sure enough, Euler was right about that one.

But in 1959 -- about 180 years after the conjecture -- three mathematicians demonstrated that Euler was wrong about 10, 14, and so on -- that, for example, one could in fact take 10 officers, from 10 regiments, and array them in the prescribed, one-of-a-kind way.

The proof was big news in mathematics. The mathematicians' accomplishment (and their photo) made the front page of The New York Times (April 26, 1959), and their work came to be known as "the Euler spoiler." Contact Tim Johnson at 660-1808 or tjohnson@bfp.burlingtonfreepress.com