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Between Series, an Actress Became a Superstar (in Math)

By KENNETH CHANG

On her Web site, Danica McKellar, the actress best known as Winnie Cooper on the television series "The Wonder Years," takes on questions that require more than a moment's thought to answer.

"If it takes Sam six minutes to wash a car by himself," one fan asked recently, "and it takes Brian eight minutes to wash a car by himself, how long will it take them to wash a car together?"

"This is a 'rates' problem," Ms. McKellar wrote in reply. "The key is to think about each of their 'car washing rates' and not the 'time' it takes them."

Ms. McKellar, now a semiregular on "The West Wing" playing a White House speechwriter, Elsie Snuffin, is probably the only person on prime-time television who moonlights as a cyberspace math tutor.

Her mathematics knowledge extends well beyond calculus. As a math major at the University of California, Los Angeles, she also took more esoteric classes, the ones with names like "complex analysis" and "real analysis," and she pondered making a career move to professional mathematician.

"I love that stuff," Ms. McKellar said last month during a visit to Manhattan after a play-reading in the Hamptons. Her conversation was peppered with terminology like "epsilons" and "limsups" (pronounced "lim soups").

"I love continuous functions and proving if functions are continuous or not," she said.

She may also be the only actress, now or ever, to prove a new mathematical theorem, one that bears her name. Certainly, she is the only theorem prover who appears wearing black lingerie in the July issue of Stuff magazine. Even in that interview, she mentioned math.

Ms. McKellar was 13 when "The Wonder Years" started in 1988 and when it ended five years later, she took a respite from acting to attend U.C.L.A. She expected that she would resume acting when she graduated, and she expected that she would major in film.

In her freshman year, though, she found that she missed the structured logic that she had enjoyed in high school math, and she started taking math classes at U.C.L.A. "I felt my brain was getting mushy," she said.

To her surprise, she excelled. Later, she was surprised by her surprise, because she had done well in math classes from elementary school through high school. But she had never considered studying math or science in college.

"It wasn't like I thought about it and thought, 'No, I can't do that,' " she recalled. "It just never occurred to me."

Next, she took the more complicated complex analysis course. The professor, Lincoln Chayes, invited her to enroll even though she had not taken all of the prerequisites. And then she had another class, real analysis, also taught by Professor Chayes.

She quizzed him with enough questions that he offered her and another student, Brandy Winn, the opportunity to tackle some original research, the first time he had given a research project to undergraduates.

For a simple model of magnetism, Professor Chayes thought that they might be able to prove a property that would indicate when the magnetic field would line up in a certain direction.

Professor Chayes tutored the two women for months on the background knowledge they would need. Then the students spent months more, up to 12 hours a day, working on the proof.

"I thought that the two were really, really first rate," Professor Chayes said.

Sometimes, they spent days on an approach before finding an obvious flaw. Other times, they thought they had finished, before Professor Chayes would find an error or oversight. And, finally, Professor Chayes found no more gaps.

A paper with an imposing title - "Percolation and Gibbs States Multiplicity for Ferromagnetic Ashkin-Teller Models on Z^2" - appeared in a British mathematical physics journal, and Ms. McKellar presented the findings at a statistical mechanics conference at Rutgers, the only undergraduate to speak.

Today, the proof is known as the Chayes-McKellar-Winn theorem.

Ms. McKellar had toyed with the idea of going to graduate school. "She certainly had the capability and talent to do that," Professor Chayes said.

But by then, she had decided to return to acting. The academic world, she said, was too isolating and lonely.

Professor Chayes said he was not disappointed. "I think disappointed is too strong," he said. "I would have been even happier if she were doing what she is doing now coupled with a career in mathematics."

Since graduating in 1998 with highest honors, Ms. McKellar has reappeared on television, in her recurring role on "The West Wing," and as a guest star on shows like "NYPD Blue" and "Navy: NCIS." Her voice has been heard in the cartoons "King of the Hill" and "Justice League." She has also written and directed a couple of short films.

The other member of the math proof team did continue in math. Ms. Winn, now Dr. Winn, completed her Ph.D. in mathematics at the University of Chicago this year.

At U.C.L.A, Dr. Winn had decided to major in math before even meeting Ms. McKellar.

But she said she had not expected to continue in the field beyond her bachelor's degree.

"Pretty much because of Lincoln and Danica, I did go on," Dr. Winn said.

Ms. McKellar remains enthusiastic about math.

She even managed to combine math and acting for one role, in a production of "Proof," the Pulitzer-winning play by David Auburn, in her hometown, San Diego. She played the main character, a young woman who claims to have solved a complicated mathematical proof.

"I don't think there is any other time in my life when I knew that this role was supposed to be for me," she said.

At an audition, the casting director asked about what she knew of math. Ms. McKellar said she was co-author of a mathematics proof.

"She went into a five-minute explanation," said Sam Woodhouse, the artistic director of the San Diego Repertory Theater. "Which was a stunning and mystifying five minutes."

Ms. McKellar said she hoped to be a role model for future mathematicians, especially middle school girls. She testified to a Congressional subcommittee in 2000 about how to draw more women into science and math.

She has just signed on as spokeswoman for the Math-a-Thon at St. Jude Children's Research Hospital in Memphis, where children work through a book of math problems, and their friends and family pledge money to the hospital for each problem that is solved.

For several years, Ms. McKellar has also been answering math questions at danicamckellar.com, under the "mathematics" link. It helps her maintain some of her skills, although she sometimes needs to consult old notes and textbooks.

"I have all of them since the seventh grade, except for my ninth-grade geometry book," she said, "which my sister used when she was in ninth grade, and she sold it at the book sale when you sell your books back.

"I was like, 'You sold my book?' She's like, 'Yeah.' 'But that was mine.' She's like, 'Oh, oops.' I have every other book."

To the person asking about the time it would take to wash a car, Ms. McKellar worked through the calculation of how long it would take if Brian and Sam worked together.

The answer: a little less than three and a half minutes. "Yes, I think they should work together," she wrote. "It gets done much more quickly that way."

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Since b_i can only take the values 0 and 1, it is necessary and sufficient to check that

$$\mathcal{R}_{\mathcal{G}}^{\mathbb{L},\mathbb{K}}(\underline{b}^*)|_{b_u,b_v=0}\mathcal{R}_{\mathcal{G}}^{\mathbb{L},\mathbb{K}}(\underline{b}^*)|_{b_u,b_v=1} \geqslant \mathcal{R}_{\mathcal{G}}^{\mathbb{L},\mathbb{K}}(\underline{b}^*)|_{b_u=0,b_v=1}\mathcal{R}_{\mathcal{G}}^{\mathbb{L},\mathbb{K}}(\underline{b}^*)|_{b_u=1,b_v=0} \quad (13)$$

for arbitrary sites u, v, and for $\underline{b}^*$ = a *fixed* configuration of spins on all sites of $\mathcal{G}$, excluding u and v. Since $a_i = 1 - b_i$, and because $H^{\mathbb{L}}_{\underline{a},\tau}$ and $H^{\mathbb{K}}_{\underline{b},\sigma}$ are identical in form, it is sufficient to check this lattice condition for $H = H^{\mathbb{K}}_{\underline{b},\sigma}$. Our desired inequality is as follows:

$$(\mathcal{Z}^{I,\mathbb{K}}_{\underline{b}}e^{\beta\psi^{\mathbb{K}}(\underline{b})})|_{b_u,b_v=0}(\mathcal{Z}^{I,\mathbb{K}}_{\underline{b}}e^{\beta\psi^{\mathbb{K}}(\underline{b})})|_{b_u,b_v=1}$$
$$\geqslant (\mathcal{Z}^{I,\mathbb{K}}_{\underline{b}}e^{\beta\psi^{\mathbb{K}}(\underline{b})})|_{b_u=0,b_v=1}(\mathcal{Z}^{I,\mathbb{K}}_{\underline{b}}e^{\beta\psi^{\mathbb{K}}(\underline{b})})|_{b_u=1,b_v=0}. \quad (14)$$

Journal of Physics A: Mathematical and General, top; Chester Higgins, Jr./The New York T

A co-author of the Chayes-McKellar-Winn theorem, top, is Danica McKellar, above, the actress who played Winnie Cooper on "The Wonder Years."

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