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math

HORIZONS

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The Number Years

Placing a Value on Values

Symbols of Power



The Number Years

Do you remember how awful it was to be 14? Figuring out who your friends were, thinking about what and who you were going to be when you grew up, and those many awkward social situations? Most of us would just as soon forget. Danica McKellar couldn't forget even if she wanted to; Danica metamorphosed through those awkward teenage years as America watched. And they still watch. In re-runs. Danica played Winnie Cooper on the hit television series (1988–1993) about coming of age in the sixties, *The Wonder Years*.

After finishing the show, America's sweetheart went on to UCLA where she graduated *summa cum laude* with a Bachelor's degree in mathematics in 1998. Currently she's busy on a number of independent films. She stole an hour away from her latest movie set to talk with us.

MH: You were growing up in real life at the same time you were busy growing up on *The Wonder Years*. Did you find that your character Winnie Cooper accurately portrayed who you were becoming?

DM: At that age you're kind of creating your character along with the producers. You're discovering how you're dealing with these issues while you're doing them yourself. While you're acting them you're also experiencing them. We created that character together. Schoolwork was important to Winnie, and I did spend a lot of time

on the set studying. More than everyone else. I mean, I was a little nerd. Every minute that I wasn't on the set working, I was studying.

MH: Did you always know that you wanted to study mathematics?

DM: I liked math in high school, but I never really thought I was going to major in it. I always thought of math as a challenging subject, but somehow the idea of majoring in mathematics in college seemed overwhelming, and something other people would do, not me. When I went to college at UCLA, I thought I would graduate with a film major, but I learned you couldn't join the School of Theater and Television until you were a junior, and in the meantime as I was fulfilling all these requirements, I began to miss math classes. I missed that feeling of solving problems in a logical setting and the way my brain organized things in my own head when I did that. Whatever you do in life, just exercising your brain with math makes you think more clearly for almost every situation. I recognized that, and I missed it, so I thought I would just take some math classes on the side.

Then I started taking math classes, and the first calculus class I took (I had taken calculus in high school, so this was midway through the calculus sequence), I memorized everything I had learned in calculus in high school. I memorized all the trigonometric identities, with integrals and derivatives



and all that stuff. On the first midterm, I thought I didn't do so well. But I thought, "This is college math, of course it's going to be hard. I should be easier on myself." As it turns out, it was a hard exam. I scored 22 out of 40 which was the highest score by far. My teacher said to me, "you did so well on this test; no one was supposed to do that well on this test." I was just blown away. I continued to be in the top of the class for most of the math classes I took at UCLA. I was *so* passionate about it, I threw myself into it, and all these teachers kept telling me how great I was, and finally I thought "I'm having a great time at this. I'm in college now. If I want to study directing and writing, I can do that after college; I can learn that other ways. I'm not going to go off after college and study math on my own. This is the place to learn math." So I went ahead and did it. And it was really good for me: in the summer of '97 I took on a research project with another student and we solved a problem, and it got published.

MH: What was it about?

An excerpt from Danica's speech before Congress:

I have had my share of run-ins with not fitting the stereotype of a scientifically-minded young woman. Every day, people approach me, and recognize me for my portrayal of the character Winnie Cooper on the television series *The Wonder Years*. And every day people ask me what I am doing now. When I tell them I took a break from acting in order to attend college, they inevitably ask what my major was. When I tell them "math," mouths drop open, mixed with stares of horror and confusion, usually followed by looks of intrigue and newfound respect, but always the incredulous, "Why?"

DM: It was on probability, on Percolation and Gibbs State Multiplicity. It appeared in the *Journal of Physics: A, Mathematical and General*.

MH: Were you considering going on to graduate school?

DM: Yes. I was seriously considering getting my PhD. I never thought about being a teacher; I was either going to be a mathematician or I wasn't. But I was missing acting and being creative in that way. I do think that doing mathematics is very creative. I never could have been so interested in it for so long if I didn't. You know, figuring out new ways of solving things. I just love that. I always loved it when I had a proof for something and somebody else had a different proof for it. What was she thinking? How did she figure it out? I do miss that now.

I got to do research and I got to experience math. As much as I loved it, it was a little isolating for me because I love to share things with my family and my friends, and as I got higher and higher in mathematics, there were fewer and fewer people to listen.

They're listening in Congress

Danica spoke before the Subcommittee on Technology of the House of Representatives in the Summer of 2000 on the importance of mathematics education.

MH: When you spoke before Congress a few months ago, what did you want to tell them? Were you speaking about being a woman in mathematics?

DM: That was so much fun speaking in front of Congress! My emphasis is not on the female thing. I hope that the way to encourage more females to do math and science is not to target

them so much and point out differences. Why say "Oh, women can do it too." What is that? Instead, let me just be female and decide how important math is for me. That's all that needs to be done in terms of PR and getting women interested in mathematics.

I concentrated on middle school. I was encouraging Congress to give more money to the middle-school age range in the sciences. Middle-school age, in terms of sciences, is pivotal because math goes from something involving rote memorization to something which involves concepts—fractions and percentages and negative numbers, things that are not everyday. Before middle school, math class amounts to memorizing the techniques of arithmetic. That's not a huge leap of faith or leap of consciousness to get, so you don't have to have the best science teachers to teach it. When you get to things like fractions and percentages and ratios and proportions and the way those all work together and how they're interrelated, I have a feeling many teachers can use the ideas, but don't understand them well enough to explain them to students so that they get the big ideas.

Not only is middle school more important because the math gets harder and we need that kind of concentration and understanding at that age, but also that's an age when the kids start to change. There's a lot of self-confidence issues that come in, a lot of questioning, a lot of self-doubt, a lot of self-esteem issues. The kids aren't used to dealing with these problems, then suddenly they hit the middle-school ages and it's all about being popular and being accepted, and if you're good at stuff. That's the age where you start saying "I'm not good at math." I don't think it happens a whole lot when

you're talking to an 8-year-old. I don't know how many 8-year-olds say they can't do math. A lot of 12-year-olds and 13-year-olds say that.

It's a very important age, the wonder years start at that age. I'm very familiar with it from first-hand experience and from being on that show. Not only are these kids insecure about their own abilities, and shut down once they're rejected in the math arena, but also they're looking for acceptance from their friends. It becomes kind of cool not to be smart, or kind of cool not to work very hard and not to really put out the effort. All those problems just combine and explode into this really big problem and math falls apart. If you look at the TIMSS studies, it shows that that is the age where students' scores really start dropping. We do fine internationally until around 4th grade. Then we start slipping a little bit. And by 8th grade, forget it. It's history. And by the 12th grade we're like number 50 or something ridiculous. So I tried to impress upon Congress that all the evidence points to the problems at that age group.

The other point that I was making was that mathematics needs more good public relations, like *Good Will Hunting*. That stuff really works. The general public listens to celebrities whether they know what they're talking about or not. If they're going to listen to me, I want to say things that are good and positive and be a good role model. I promised Congress that I would do what I could, and they needed to do what they could in terms of funding public relations programs like *Math is Power* and *Figure This!*.

Figure This!

MH: One of the reasons you were chosen to speak before Congress was because you're the spokesperson for *Figure This!*?

DM: I imagine. All I know is that I'm kind of unique in that I'm a young celebrity who did some serious mathematics. And I'm female. I don't think there's anyone else like that. I know that on that subcommittee they were really looking

for female role models and people who would be influential, and they wanted to get attention. Since I'm a young celebrity who does mathematics, and everyone remembers *The Wonder Years*, it just garners a little extra attention.

MH: What is *Figure This!*?

DM: *Figure This!* is a government-sponsored program geared toward middle-school students designed to encourage them to enjoy math in real-world settings with their parents. It's a series of math challenges online (figurethis.org). They're really cute problems that make you think mathematically, but they don't really look like math problems. For instance, one of them is the question: Why are manhole covers round? Well, if you had a square shape, for instance, you could pick up the lid, tilt it, and it would fall through. A circle is the only shape that has a constant diameter. And that's an interesting thing. Then to realize that's the definition of a circle, actually. It makes you think. Even an octagon still has that problem of a longer diameter and a shorter diameter where you can tilt it and it will fall through.

They try to design the questions to be things that you can just talk about with your parents at the dinner table. Here's another example: If you could make \$20 a day for the next three weeks, or if you could make 1 penny the first day and double it each day for the next three weeks, which one would you pick? It's so surprising.

For about two years now Danica has maintained her own website (www.celebritysightings.com/mz-danica_index.cfm) where she answers all sorts of questions about school experiences, teachers, schoolmates, and she has a specific page devoted to answering questions about mathematics. She answers all the mail herself.

MH: Does it take a lot of time?

DM: Well, I don't do that many at a time because they are very time consuming. Especially the math ones. It's hard to type out explanations when you don't have a chalkboard, you can't use your hands, you can't draw pictures, and the person isn't there to say, "Wait, what do



you mean by that?" So I try to describe it in a way that's covering all the bases without assuming any prior knowledge.

MH: What are you trying to do with the web site?

DM: I just want to encourage people not to be afraid of math. And I hope that my image, my face, is one that says familiarity and friend and fun. Math is a different language. I learned that when I was in 7th grade and hit a personal roadblock in mathematics. I will always remember Mrs. Jacobson whose faith in me at that moment was perhaps the greatest gift of encouragement I have

ever received. I offered Congress my services as a personality, an actress, and a mathematician to help any programs aimed at encouraging young people to pursue math and science.

In addition to her advocacy and activism for mathematics, Danica has roles in several films soon to be released: *Jane White is Sick and Twisted*, *Topanga*, *Good Neighbor*, and *Extreme Close Up*. She is composing her own music and has just finished her first screenplay. Clearly, this is one former adolescent for whom the wonder years continue. ■

Treasure Hunt Winners

The ballots have been counted and recounted, no chad has been left unturned. The winners of the *Math Horizons* World Wide Web Treasure Hunt are: Erica Voolich of the Solomon Schechter Day School, Scott Hunter of St. Mary's College of Maryland, and Kim Groshong of Ashland University. Erica and Scott were the only entrants to answer all 15 questions correctly. Kim was one of several to correctly answer 14 of 15, her submission has been posted on the *Math Horizons* web page http://turing.mathcs.carleton.edu/math_horizons/. Each of these three has been sent one of the coveted (and handsome) *Math Horizons* t-shirts.

Honorable Mention (at least 13 correct answers) to: Kristine Harootunian, St. Lawrence University; Catherine Timmins, Aycoc Middle School; Solomon Willis, Shelby, NC; Ali Bukhari, Meriden, CT; Sara Wood, St. Lawrence University; Farhad Farzad; Amanda Febey, St. Olaf College; Josh Harris, Greensboro, NC; Lynelle Weldon, Andrews University; Gretchen Koch, St. Lawrence University; Charlotte Knotts-Zides's Calculus class, Wofford College; Vivek Bachhawat, St. Lawrence University.