Review: [Untitled]

indeed a rare book: one that lives up to the self-praise that adorns its jacket. Professor Nahin has delivered the real goods.

The reader who wishes to explore the history of the complex number system in greater depth may also wish to consult another informative, albeit less whimsical, book: *Numbers*, Heinz-Dieter Ebbinghaus et al., Springer, 1991.

University of Northern Colorado, Greeley, CO 80639
rdiaz@bentley.unco.edu

Leaning Towards Infinity. By Sue Woolfe. Faber and Faber, Boston, 1997 (originally published by Random House Australia, 1996), xxi + 393 pp., $24.95 hardcover, $14.95 softcover.

Reviewed by **John Beebee** and **Karen Willmore**

Are you curious about why men outnumber women in your advanced mathematics classes? Or are you interested in what a gifted writer who claims to know nothing of mathematics thinks about the feelings and motivations of its practitioners? If so, then you will find this a tempting novel, as we did. Its premise is that the search for truth in life, love, and mathematics is a messy and risky business.

> I think it all began because of the shape of my mother's breasts. And it definitely began with something my mother wrote on the margin of a page stuck on the wall: Frege said that the line connecting any two points is already there before we draw it. (p. 3)

What is this "it" described by Frances Montrose, a gifted amateur mathematician, damaged daughter of another gifted amateur, Juanita, and mother of her biographer, Hypatia? (And what if the Bernoullis had been mothers and daughters instead of fathers and sons?) Frances has just won a competition for amateur mathematicians and has the opportunity to present the joint ideas of herself and her mother at a conference in Athens, Greece, the birthplace of modern mathematics. In another possible beginning, Hypatia summarizes the plot as the story of "an Australian woman who'd never had any formal mathematics training but who in 1995 carried across the world, inside a borrowed suitcase and amongst ball dresses, a bulging three hundred and fifteen pages of revolutionary theorems, and something else no one knew about—the beginnings of the discovery of a new kind of number" (p. xiii).

The emotional core of the novel is interwoven around four generations of unresolved mother-daughter relationships. Beautiful Juanita, abandoned by her self-centered mother, is a mathematical genius who in unthinking rebellion marries a man who can't count past ten. Her mathematics, compulsively pursued during stolen time, almost reaches a breakthrough. She pins her love and her mathematical dreams on her beautiful son, who has no use for either. Frances, her very plain daughter, is so consumed with trying to win her mother's love and recognition by completing her mother's mathematics that she neglects her own daughter, Hypatia

—who despite her name, claims that she can barely add. Hypatia tries to break this destructive cycle with her own daughter, Zoe, by writing down the story of her mother's life. Is it possible, this novel asks, to be both a mother and a great person? For as Hypatia writes, motherhood is "about the allocation of the soul" (p. 216).

In an interview on Wisconsin Public Radio (The Beauty of Math, 11/4/97), Sue Woolfe told of how she, a nonmathematician, came to use mathematics as a metaphor of who we are. She was living in an isolated place, nursing a baby, and listening to the ramblings of her neighbor, a mathematician dying of cancer. He talked not about his disease but about mathematics, and she came to realize that mathematics was as exotic and wonderful to him as her baby was to her. Woolfe went on to explain how she sees the connection between mathematics and love: both are full of assumptions that the mathematician and the lover accept on faith, with no guarantees of certainty.

According to the root meaning of the word, amateurs are those who love what they do, and it is in this sense that Woolfe characterizes her very gifted female mathematicians as amateurs. In a family tree at the beginning of the novel, Juanita is labeled a "housewife and secret mathematician," Frances an "English teacher and amateur mathematician," and her one-time husband a "professional mathematician." Frances' husband would never discuss mathematics with her and left her as soon as their daughter was born. Woolfe portrays professional mathematicians mostly as conceited, ambitious, and rude (and male), more concerned with defending the established profession against outsiders than with mathematical ideas. She comes down solidly on the side of "cranks," those rare brilliant outsiders who are in love with mathematics. She even begins her novel (yes, another beginning) with the most famous crank story of all—the story of Srinivasa Ramanujan.

Juanita once confesses to a young Frances, "I'm in love with thinking. I don't mean thinking things through or thinking things over or thinking things out.... Thinking itself.... It's as abstract as death.... All the mess of life removed. And what's left, it can go anywhere" (pp. 122–123). For Frances, mathematics is very much connected with her mother's beauty: "She's always been mathematics to me, beautiful beyond compare, unbearably elusive, unbearably unknowable" (p. 250). She says doing mathematics is like being "in an undiscovered country... and I'm like a blind person. There's something up ahead of me, and I don't know what it is. I'm feeling with my hands a bit sticking out here, and a bit going in there. Maybe over here is an arch. Maybe over there is a tunnel. It's like something that might be a labyrinthine cathedral" (p. 46).

Woolfe tells the story of these women's lives and loves in anything but a straightforward, linear fashion. She warns us of her casual attitude toward time in the family tree, which ends with Juanita's great grandson being born in 2003. Frances relates her experiences in Greece as occurring in the present, but then all through her story (which actually is being told by Hypatia as if she were her mother) she randomly digresses to recall her childhood, which in turn is interspersed with recalling her mother's story. Hypatia, meanwhile, constantly interrupts all this retelling with her own asides, sometimes interpreting events, sometimes telling her own story as Frances' daughter, sometimes telling stories of famous mathematicians from the past (including the historical Hypatia). Initially, this is all very confusing for us as readers, and a certain amount of perseverance and faith is required before one begins to sort out just what is happening to whom and when—which may be not unlike doing mathematics. At any rate, Hypatia, in one of her digressions, gives this justification: "My mother's mind was probably

never one of those minds that travel in straight lines. Who knows? That may have been the secret of her greatness. . . . (Some might say that digression is to be expected of a mathematician, that mathematics *is* a digression)" (pp. 9–10).

Before assigning *Leaning Towards Infinity* to our book club, composed of mostly academic types with a token physician, I (Karen) had John read it to make sure that the mathematics made sense. All but one book club member liked the novel very much; all agreed that it was confusing at first; one person disliked the metaphoric and image-laden language. Australians really like this book: it was the best-selling Australian novel in 1996.

I (John) half anticipated a mixture of feminism and superficial impressions of what mathematicians do, written in a painful and pretentious literary style. What I found was different. Although the prose was painful to me at first, it became more natural as I got drawn in and began to untangle the threads of the story. Woolfe has an unusually sensitive grasp of the process of mathematical creation, and I found her thinking about motherhood and mathematics to be uniquely her own. The mathematics conference in Athens—surreal, funny, and moving—should not be missed.

Department of Mathematical Sciences, University of Alaska Anchorage, Anchorage, AK 99508
afjcb@uaa.alaska.edu
Women's Studies Program, University of Alaska Anchorage, Anchorage AK 99508
afkew@uaa.alaska.edu

From the MONTHLY 25 Years Ago . . .

THE COMPUTER ILLITERACY PROBLEM: A PARTIAL SOLUTION

PETER G. LYKOS

1. How the computer is affecting education. The computer is transforming the ways in which the problem solvers and the decision makers of our society go about doing their jobs. Not only are old problem-solving techniques being speeded up and scaled up, but new techniques are being invented and developed which would not have been considered seriously before the invention and proliferation of the computer. And the proliferation of the computer is being accelerated as a direct consequence of two technological developments:

1. The low cost and increasing flexibility of *minicomputers*, and
2. The increasing flexibility and ease of use of *tele-communications* systems whereby users can use a typewriter-like or keyboard plus TV-like terminal to access a variety of computers remotely located.

MONTHLY 81 (1974) 393