

# Preface

*Women in Mathematics: Celebrating the Centennial of the Mathematical Association of America* presents a collection of papers on the contributions, achievements, and progress of women mathematicians, mostly in the twentieth and twenty-first centuries, emerging from the themed contributed paper session “The Contributions of Women to Mathematics: 100 Years and Counting” at MathFest 2015, sponsored by the Association for Women in Mathematics to celebrate the 100th anniversary of the Mathematical Association of America. As such, the collection contains a diverse mix of current scholarship and exposition related to women and mathematics rather than a balanced coverage of women during this time period. This volume is intended to be an interconnected collection of biographies, histories, studies, reflections, cultural discussions, and other articles related to women in mathematics, primarily but by no means exclusively in the English-speaking West. The articles provide compelling, interesting, and informative reading for mathematicians, historians of science, teachers of mathematics, and students at the high school, college, and graduate levels, and in general anyone interested in attracting more girls and women as students, faculty, and/or employees.

It is an opportune time to look back at the accomplishments of women in mathematics. Mathematical culture has subtly shifted over the past century and certainly during our lifetimes. Some of the visible indicators include a greater number of women filling tenure-track and tenured academic positions, receiving prestigious awards and honors, being invited to give plenary addresses, serving in leadership positions in professional societies, and, in general, being more visibly active in the mathematical community. There are far too many notable moments to list, but here are a few related to women in mathematics in the USA that have inspired us personally:

- 1886—The first woman known to earn a PhD in mathematics in the USA was Winifred Edgerton Merrill, from Columbia University.
- 1932—Emmy Noether delivered the first plenary lecture by a woman at the International Congress of Mathematicians, a year before she moved to Bryn Mawr College in the USA.

- 1943—The first minority woman known to earn a PhD in mathematics in the USA was Euphemia Lofton Haynes from the Catholic University of America.
- 1971—Mary Gray of American University was the first chairman/president of the newly founded Association for Women in Mathematics.
- 1976—Julia Bowman Robinson of the University of California, Berkeley, was the first female mathematician elected to the National Academy of Sciences, one of the highest awards a scientist can receive.
- 1998—Melanie Wood of Park Tudor High School in Indianapolis became the first female member of the US team for the International Mathematical Olympiad, going on to earn a silver medal.
- 2014—Maryam Mirzakhani of Stanford University was the first woman to be awarded a Fields Medal, one of mathematics' highest awards.
- 2015—Katherine Johnson, retired from NASA, was the first female mathematician to earn a Presidential Medal of Freedom, the highest civilian award in the USA.

Despite women's gains, we know that not all mathematics students have access to strong role models or opportunities to engage with female mathematicians at conferences, at workshops, or on their local campuses. Three of us remember the thrill of meeting a female mathematician for the very first time. For Janet, the mathematician was Gloria Hewitt, who delivered a pitch-perfect talk on group actions just as Janet was taking the abstract algebra sequence at her undergraduate institution. (Hewitt had advised the PhD dissertation of one of the mathematics professors there and visited the campus at his invitation.) Sarah began her undergraduate career as an engineering major but was also interested in mathematics. So she looked for someone to talk to and happened upon Susan Niefeld, a category theorist, who would later become her advisor, mentor, and much more. Sarah's mom died later that year—from driving her to the train station to helping her navigate through financial aid and other issues, Niefeld was instrumental in helping Sarah stay in school and encouraging her interest in mathematics. Jackie added a mathematics degree late in her undergraduate career and so first encountered a female mathematician, Marie Vitulli, at the University of Oregon as a PhD student. Marie challenged her students and held them to high standards. Marie also lobbied vociferously for excellent female job candidates to expand the number of role models available to women at U of O. Maura's father was a mathematics professor at Notre Dame, so she grew up knowing (a few) female mathematicians. In her senior year at Notre Dame, she was thrilled to take a graduate course on mathematical logic with Julia Knight.

We hope that this volume will provide inspiration to its readers, showing them how women have made substantial contributions, as individuals and as groups, to mathematics research, mathematics education, mathematical culture, and outreach, and inspiring them, in turn, to encourage women and girls to pursue mathematical careers. It contains some biographies of women in mathematics, but not the typical set of "famous" biographies. Instead, the volume features diverse biographies of women, including some who made a difference in ways that might at first glance

seem small but were significant either for their time or for the individuals who were influenced by these women. Articles take the form of a focus on individuals, groups of students or women, groups that include women, or other connections. Some articles update and expand work on women in mathematics previously published. The book also contains expository articles and showcases how the role of women in mathematics has changed over time. As the conference session at MathFest 2015 celebrated active scholarship by women in mathematics, so too does this volume. The diversity of topics and multiplicity of authors of individual articles ensures a wide variety of perspectives. We hope you enjoy reading these chapters as much as we have.

We are grateful to the individuals and organizations that supported the formation of this volume. Alissa Crans was co-organizer, along with Maura and Jackie, of the paper session that inspired this volume and we owe her tremendous thanks for contributing to the original vision of promoting contributions by women to mathematics. We thank our dedicated and talented chapter authors, six of whom participated in this paper session and all of whom devoted significant time and energy and brought considerable passion and skill to their contributions to this volume. We also thank the wonderful referees who graciously helped us shape the articles in this collection. Fordham College at Rose Hill administrative assistant Susan Legnini provided organizational and administrative support in the early stages of this project, and Sarah Duncan, doctoral candidate in clinical psychology at Fordham, assisted with typesetting and proofreading a number of the chapters. We have all been inspired by the leadership of AWM past president and AWM-Springer series editor Kristin Lauter, who provided important early encouragement to us to organize this volume. We also appreciate the advocacy and community of the Association for Women in Mathematics; for all of us, our involvement with AWM has been fundamental in the development of our mathematical careers. Finally, we extend deep thanks to all of the women in mathematics who have come before us: they are the ones who made this book possible.

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