

Preface

You often hear, “When will we ever use this?” in regards to content in pure mathematics courses, and while as mathematicians we can appreciate the beauty of mathematics, our students often want more. They rarely get to apply the knowledge they learn to other disciplines and often fall short on seeing its use in future careers. Broadening the course content and uses of our field can help make mathematics more appealing to a diverse population of students. The material in pure mathematics can be used in almost EVERY discipline—the arts, history, religion, literature, anthropology, social justice, politics, medicine, just to name a few.

This volume is intended to serve mathematics instructors teaching pure mathematics courses who would like to offer their students an insight into the applications of mathematical topics that are often presented as being ephemeral. This volume is an easy-to-reference collection of activities and projects that are ready to be used or adapted for implementation in the reader’s course. Each chapter details a course project or set of activities that can be easily covered in at least one pure mathematics course. Most of these projects can be completed in just a few class periods, though some are longer. Each project will focus on the application of specific mathematical topics to a particular cross-curricular area of interest.

The demarcation between pure and applied mathematics is not nearly as stark as many undergraduate mathematics students are likely to suspect. Fueled by tradition and habit, the mere existence of this division itself has allowed it to become self-perpetuating; applied courses are increasingly taught with a focus on industry and interconnectedness to other disciplines while pure courses are often allowed to become self-contained adventures into some realm of esotericism. This need not be the case! Every traditional pure mathematics course covers topics and tools that are utilized in other fields of study.

The intention is that the chapters in this book will engage instructors and students with pure mathematics material in a new way. By using these projects in class, instructors will promote active learning strategies, which can bolster a course’s inclusivity by allowing students a different means of engaging with course material. Students will not simply be “learning” the course material; by implementing these activities in class, students will be *using* the course material.

Each chapter has the same general structure and sections that address the content specified. Each author has been granted the freedom to write in such a way as best serves their particular topic while still maintaining a general sense of uniformity for the reader’s benefit. In addition to a detailed description of the project or activity, each chapter also generally includes the following:

- A brief introduction that gives a summary of the project, the specific course topic(s) the project reinforces, a summary of the cross-curricular application and how it fits with the material of the project, as well as the number of students in the course where this project should be used and the expected time to complete the project or activity.
- A prerequisites and preparation section that discusses the concepts and ideas that are required to complete the project, any skills required that aren't typically covered in the course, and any preliminary assignments that students should complete.
- A section that includes extensions or alterations of the project/activity for a longer or more intensive course project or for a research project.
- A reflections and advice section that mentions tips about how best to implement the project as well as common points of struggle for students.
- Additional resources that the instructor may find helpful such as relevant sources that highlight the interdisciplinary nature of the project, links to data sets or useful technology that have not been mentioned previously, and other outside material that would be useful.

Moreover, many authors have also chosen to include appendices that contain project rubrics, solutions to the exercises, and other useful items that would be helpful for an instructor using this project. (To keep the length of the book manageable, many of these appendices have been moved online to the Supplemental Materials section on the book's website.) We should, however, note that instructors should be cognizant of the impact that some of the projects or activities may have on students, particularly those projects that have a focus on social justice. That being said, that does not make these projects less useful or important—these are important topics to tackle in all classrooms, including mathematics classrooms.

When putting together this book, we placed an emphasis on finding course activities that draw connections to more varied and atypical curricula. In reading the chapters, you might be inspired to expand upon the project or learn more about a topic. Nevertheless, the intention is that you can easily adopt the materials with as little work as possible by the instructor, and that these projects will satisfy (and ultimately attract) more students to pure mathematics courses. The age-old question of, “When will we ever use this?” does indeed have an answer—often a surprising one.

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