

Purpose and Target Audience

Purpose

The foreground purpose of this book is to provide an elementary introduction to the theory of groups by:

- ignoring the potential *width* of the material and
- concentrating on the *depth* of coverage instead

It is our personal experience that once the foundations of a technical area of study are understood thoroughly, the progress in the said study tends to be more pleasant, enjoyable and expedient, with a moderate amount of immediate and pointwise care required.

For example, as an early exercise, our readers will compute the total number of possible *mappings* of one arbitrary finite set to another arbitrary finite set and, as a result, they will discover that the number of such mappings grows quite large quite fast as the cardinalities of the participating sets grow.

We will, next, limit our attention to just three important classes of mathematical mappings, as we look in some detail at *a surjection*, *an injection* and *a bijection*.

In our introductory study of the theory of groups, however, we will be mostly interested in just one specific class of mappings - that of a bijective mapping of a finite set onto itself.

Does that mean that all this legwork that we will do is a throwaway?

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We hope that the answer to that question is a *no* because *all this legwork* is exactly the device that will facilitate the deeper understanding of a very important material that goes deep into the theory of groups.

A way in which a study of any technical layer may be undertaken is not that different from how a naturalist may undertake the study of animals.

At one extreme, a naturalist may go directly into the jungle, get wet and wild and, crawling through the bush, make an attempt to get up close and personal with an animal of interest and observe that animal in its natural habitat.

At another extreme, a naturalist may go directly into a library, dive into a mountain of books and study the same animals by looking at their images and by reading the relevant articles about these animals compiled and written by someone else.

Somewhere in between the above two extremes there sits a trip to a zoo.

That hybrid approach is what we will favor in this book, as we shall spend our time mostly near the entrance to the group-theoretic zoo with a few books on hand, a pencil and reams of paper - please see the *What Makes It Perfect* chapter for more details.

We, thus, hope to provide enough basic information that will, this way or that way, nudge our readers toward falling in love with this beautiful discipline to which we refer as the theory of groups.

The background purpose of this space is to introduce our readers to the way in which the grown-up mathematics is done and to, hopefully, showcase how a small number of, on the first reading, *breathtakingly* simple but equivalently *deep* ideas can give birth to an awesomely powerful theory.

Target Audience

The primary target audience of this book are the motivated upper middle and lower high school students or the crowd whose age supremum is about 14 or 15, the smallest age that is high enough for a meaningful introduction to the basic ideas and notions of the theory of groups.

However, that does not mean that anyone older or younger should not pick up and work their way through this book.

On the contrary, we tried to make the material covered in this text accessible to the widest audience possible by making virtually no initial assumptions about prior levels of mathematical training of our readers. Just about the only prerequisite for gaining the most academic benefit from this book is intellectual openness and a natural, sincere and genuine desire to learn. Because we organized this book

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in a self-learning format, all it needs is a curious person who is receptive to new ideas and who is not afraid to fail a few times before finding a solid footing and a measure of success in new endeavors.