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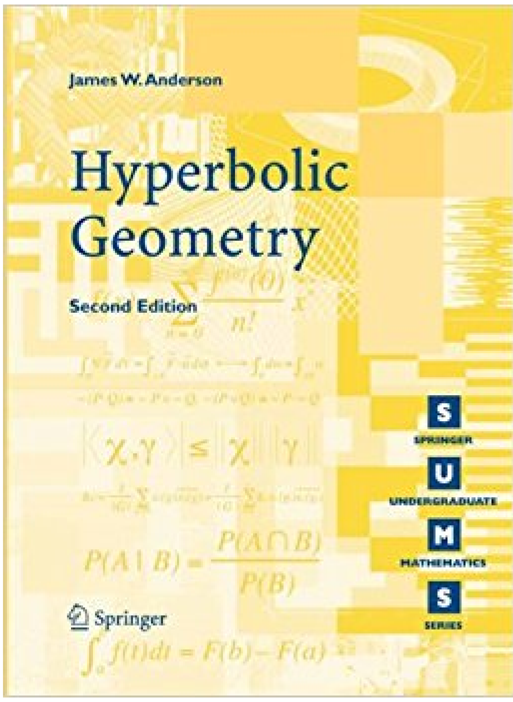

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Synopsis

The geometry of the hyperbolic plane has been an active and fascinating field of mathematical inquiry for most of the past two centuries. This book provides a self-contained introduction to the subject, providing the reader with a firm grasp of the concepts and techniques of this beautiful area of mathematics. Topics covered include the upper half-space model of the hyperbolic plane, MÃƒÂ¶bius transformations, the general MÃƒÂ¶bius group and the subgroup preserving path length in the upper half-space model, arc-length and distance, the PoincarÃƒÂ© disc model, convex subsets of the hyperbolic plane, and the Gauss-Bonnet formula for the area of a hyperbolic polygon and its applications. This updated second edition also features: an expanded discussion of planar models of the hyperbolic plane arising from complex analysis; the hyperboloid model of the hyperbolic plane; a brief discussion of generalizations to higher dimensions; many new exercises.

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Customer Reviews

The author has an inexplicable aversion to diagrams - curious for one writinga text on geometry. Too often he spends entire paragraphs or even a whole pagewriting out in tedious text format what could be conveyed at a glance by eventhe simplest of illustrations. This is especially unforgivable in an undergraduatebook and may give newcomers the distorted view that more is going on than isactually the case . Why obscure such a beautiful subject ?

*Preface: I am a senior mathematics undergraduate, and I took my hyperbolic geometry class at UCSB in 2013, using this textbook.A fairly readable introductory text on hyperbolic geometry. Anderson’s style is very rote - long dry spells filled with theorems, proofs and lemmas, few examples, somewhat obscure explanations, and a surprisingly scarce diagrams and figures. Approaching this textbook may be daunting at first, like many SUMS (Springer Undergraduate Mathematics Series) texts, and it will certainly take a lot of time with one’s nose buried in the definitions to get an intuitive understanding of what is going on in the upper-half plane.Anderson is a proponent of the Erlangen program, the idea that studying a symmetry group is the same as studying geometry. The book starts off with a definition of the upper-half plane and projective geometry, and quickly launches into the study of the MÃƒÂ¶bius group and MÃƒÂ¶bius transformations. Within a few pages Anderson is throwing around the vocabulary of group theory and diving into the dense algebra of MÃƒÂ¶bius groups and their transitivity properties. This critically important chapter is likely to go over the heads of those who are not willing to work through the examples and exercises, which is often easier said than done. Some of Anderson’s choices for examples are just downright obtuse and, by his own admission, "not chosen for [their] numerical elegance." Most of the exercises are fairly doable and have brief solutions or outlines for solutions provided. There are also some exceptionally challenging exercises, especially in chapters 2 and 5, which require truly creative thinking.While the book touches upon complex analysis, group theory, and differential geometry, none are explicitly required to understand the material. However a thorough mastery of multivariable calculus is an absolute must, and it would help to have knowledge of fractional linear transformations and the algebra of complex numbers. For those students who have made it this far in their math career, the calculus of arc length and distance in the hyperbolic plane (chapter 3) shouldn’t be too intense, and its computational nature makes the lack of examples less important.It’s not until chapter five that many familiar concepts of geometry are even mentioned - area, angle measure, convexity, and shapes. It’s only once the reader reaches this stage, almost at the end of the book, that Anderson’s presentation begins to make sense and the strangeness of the hyperbolic plane becomes tangible. It is the most challenging chapter but also the most rewarding, and it was the pacing and writing of this chapter that swept away all of my ill feelings I had about the subject up until that point.Still, I hesitate to think of how many readers have shelved this book after being stumped by the confusing treatment of the MÃƒÂ¶bius group, or how many students have dropped their non-euclidean geometry class due to the book’s aloof presentation and rocky second chapter (my own course dropped from 40 to 16 students before the first midterm). Perhaps the biggest disappointments are chapters 4 and 6, which give incomplete treatments of the PoincarÃƒÂ© disk model and the hyperboloid model and are basically just teasers for more detailed study. Overall Anderson’s book is instructive, but requires more time investment than you would expect for a 200-page textbook.If this is your textbook for a hyperbolic geometry class, you need this book, as your syllabus will most likely follow the order of presentation of the book. If you are looking for a book to learn hyperbolic geometry on your own, I would probably suggest you look elsewhere, unless Anderson’s style seems like the right fit for you.

My review is based on the first edition.This book is a tour-de-force. While it is stated to be for undergraduates, I would caution that only those undergraduates with a solid grounding in calculus will be able to follow many of the technical details. To alleviate that, Anderson provides many examples and solutions to all the generally excellent exercises in his book. He does some lengthy calculations as well.His primary focus is on the upper half plane model H and its group Mob+ of Mobius transformations. He adopts Klein’s viewpoint that the group and its invariants are primary. So it was a pleasure to see worked out in detail why |dz|/y (up to a positive constant multiple) is the Riemannian line element for H: It is the only conformal distortion of the Euclidean line element that is invariant under the group Mob+ (Theorem 3.5). He then works out the global metric on H.I was sorry to see from its table of contents that in the second edition he deleted his chapter about discrete subgroups of Mob acting on H and their fundamental polygons. He did replace it with a discussion of the hyperboloid model, which is important for special relativity.

I used this text along with Tristan Needham’s "Visual Complex Analysis" to get a full dose of the geometric beauty inherent in studying complex variables. I found it to be a nice complement to the second year course in geometry at Cambridge University. Anderson does a wonderful job of working out in detail lots of examples so that you can get the algorithmic practice of solving problems. However this is not merely a cookbook. Rather, core elements of the theory are presented from the ground up, with plenty of time spent on understanding the group structure of Mobius transformations in various settings. Disc and upper-half plane models are treated as well as more general models. I recommend you buy both this book and Needham’s if you want to appreciate the world of complex numbers.

This is an excellent introduction to hyperbolic geometry. It assumes knowledge of euclidean geometry, trigonometry, basic complex analysis, basic abstract algebra, and basic point set topology. That material is very well presented, and the exercises shed more light on what is being discussed. Plus, solutions to all the exercises are at the end of the book.

this is a really great introduction to hyperbolic geometry. especially if you want to study gammas acting on the upper half plane. it starts at a much lower level then any other text.

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