

How to Use Self Study Edition

Do not just pay attention to the words;
Instead pay attention to meanings behind the words.
But, do not just pay attention to meanings behind the words;
Instead pay attention to your deep experience of those meanings.
— Tenzin Gyatso, The Fourteenth Dalai Lama[†]

This quote expresses the philosophy upon which this book is based. This book will present you with a series of problems. You should explore each question and write out your thinking in a way that can be shared with others. By doing this you will be able to actively develop ideas prior to passively reading or listening to comments of others. When working on the problems, you should be open-minded and flexible and let your thinking wander. Some problems will have short, fairly definitive answers, and others will lead into deep areas of meaning which can be probed almost indefinitely. You should not accept anything just because you remember it from school or because some authority says it is good. Insist on understanding (or seeing) why it is true or what it means to you. Pay attention to **your** deep experience of these meanings.

Solutions (some of them sketchy) to all problems are at the end of this book. However, before you read a solution, I urge you to think about the problems and express your thinking about them even when you know you cannot complete the problem. This is important because it helps build self confidence. You will see what your real difficulties are. When you read a solution or proof later, then you will more likely see it as answering a question that you have.

It is also important for you to keep in mind that there is more than one correct solution and the solution at the back of the book may not be the best one for you. There are many different ways of solving the problems — as many as there are ways of understanding the problems. *Insist on understanding* (or seeing) why it is true or what it means to you. Everyone understands things in a different way, and one person's "obvious" solution may not work for you. However, it is helpful to talk with others —listen to their ideas and confusions and then share your ideas and confusions with them.

Also, some of the problems are difficult to visualize in your head. Make models, draw pictures, use rubber bands on a ball, use scissors and paper — play!

Throughout the text there is an emphasis on looking at curves and surfaces in as many different ways as possible but with a particular emphasis on intrinsic, coordinate-free approaches in order to highlight the geometry. Those readers who wish to avoid local coordinates may, in general, do so by leaving out the problems and sections that refer to them. From the beginning through Problem 4.7 local coordinates are used only as examples. Local coordinates and the associated formalisms are needed in a crucial way only in Problem 4.8 and in the problems following Problem 6.1.

Those readers who have access to computer systems running Maple©, Mathematica©, Derive©, or similar software can use these systems to facilitate gaining geometric intuition and imagination of the concepts of differential geometry. In Appendix C we have included several computer exercises for Maple© and these and additional scripts are also available for downloading on-line at

<http://www.math.cornell.edu/~henderson/books/dg.html>

Similar scripts for other programs should be easily constructed. These exercises are labeled according to the problem in the text to which they are most applicable. They are also referenced at appropriate points in the text. However, the current state-of-the-art for generally available computer graphing programs is not capable of producing what would be the most useful displays. I hope that interested readers will add to the available collection of scripts by sending to me (dwh2@cornell.edu) their scripts or URL's to where their scripts are available on the WWW. Please also use this same e-mail address to send any comments about the book or its use.

[†]From an unpublished lecture in London, April, 1984. Used here with permission.