quadratic equations and similar triangles, and several ideas involving origami. Did you know that it possible to trisect an angle by paper folding? This book tells you how – although I have a reservation about the proof, which seems to skate over what is surely the crucial step. But that is a minor cavil, and, after all, part of the authors’ philosophy is that you must do much of the work yourself. Altogether, then, an excellent (if somewhat expensive) resource, and if you have it on your shelf then there really should be no excuse for not knowing how to fill those dead lessons after examinations are over!

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The guiding principle for this book is to study the history of mathematical ideas through the accounts of the pioneers. Since the book is aimed at students rather than researchers, the use of ‘original’ material is not carried to the extent of reproducing their original language, a feature that makes the book instantly more accessible.

Five topics are considered, each in some depth. Each chapter consists of a historical account of one of these topics, followed by extended excerpts from selected classical works. However, the writings of the ‘masters’ are not the only source of quotations. Several shorter passages are included from some of the 181 books on the history of mathematics listed in the bibliography. The overall effect is rather like having a guided tour of a good library.

The first chapter deals with the parallel postulate and the discovery of non-Euclidean geometry, with a general introduction followed by quotations from the writings of Saccheri, Legendre, Lobachevsky, and Poincaré. The chapter includes many exercises for the student, some of which encourage them to make connections, such as Ex. 1.23: ‘Which of Saccheri’s three hypotheses about angles in Saccheri quadrilaterals holds in Poincaré’s unit disc model?’ Ex. 1.1 is a bit more open: ‘Read about world history from 1750 until 1850.’ I don’t think this means read for a century (or even an hour).

The second chapter investigates the development of set theory. The introduction again provides an overall picture, which is followed by fairly substantial extracts from Bolzano’s Paradoxien des Unendlichen, Cantor’s Beiträge zur Begründung der Transfiniten Mengenlehre, and Zermelo’s Untersuchungen über die Grundlagen der Mengenlehre, I.

The section on analysis starts its journey well back in history with two visits to Archimedes, before leaping forward in time for a brief stop with Cavalieri. Rather more time is spent with Liebniz and Cauchy, before moving on to Abraham Robinson for a resurrection of infinitesimals.

Chapter four traces Fermat’s last theorem from Euclid’s classification of Pythagorean triples, through Euler’s proof that a square cannot be the sum of two fourth powers, to Sophie Germain’s more general approach to the so-called ‘first case’. The last section deals with Kummer’s major leap forward through the development of algebraic number theory. The inclusion of this chapter is understandable, given the topic’s popular image, but it adds little to H. M. Edwards’ (rather fuller) account [1]. Where it has the advantage over Edwards is in its description of recent events, with brief accounts of the work of Faltings and Wiles.
The last chapter of this appealing work deals with algebra, focussing on methods for solving polynomial equations in terms of radicals. The usual suspects are interrogated: Euclid for quadratic equations, Cardano for the cubic, Lagrange for his involvement beyond the quartic and finally, the revolutionary Galois, who is generally considered to have killed the problem stone dead. Actually the extract from Galois is quite short, but considering the difficulty that his contemporaries had in understanding his work, this is perhaps an act of kindness.

In summary, this book could serve as the basis of a history of mathematics course or serve as motivational supplementary reading for students taking courses in geometry, set theory, number theory, analysis or algebra. For all mathematically competent readers (as Gazette subscribers are assumed to be), Mathematical Expeditions can be treated as a more-than-usually well-informed popular account.

Reference

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For many years Paul J. Nahin, who is Professor of Electrical Engineering at the University of New Hampshire, has taught a beginner’s course in probability theory to second-year students in his department. At the end of each term he sets a challenge problem. Everyone who accepts the challenge (they must decide before seeing the problem) has to hand in a solution, and their final examination score is increased if it is correct, and reduced if it is wrong. This book is a collection of 21 of these problems, their solutions and 42 associated computer programs. There is also a chapter on random number generators, and a rather whimsical two-page short story.

In the preface, the author gives a two-part statement that underlies the assignments. This is ‘No matter how smart you are, there will always be a problem harder than one you can solve analytically’, and ‘If you know how to use a computer application ... you may still be able to solve that “too hard” problem by simulation.’ Nahin will probably upset mathematicians by his approval of the statement ‘Only wimps do the general case. True teachers tackle examples.’ However, don’t let that put you off—most teachers use specific examples to illustrate new ideas and techniques. And although many of Nahin’s problems use specific numerical values, he is, by this definition, at times rather wimpish, since some of his problems lead to general results!

The publisher’s blurb talks about ‘favorite puzzles’ – in fact the author invented them all, and any that may seem familiar have a new slant that gives them some originality. The problems vary in difficulty. For instance, the first problem, How to ask an embarrassing question, needs only a little simple arithmetic. The others are much more demanding, requiring such things as the approximate numerical evaluation of an infinite series with no closed form, the use of double integration, or an acquaintance with the exponential integral and Euler’s constant $\gamma$.

The problems are introduced discursively, sometimes starting with a discussion of a related problem, sometimes with a relevant anecdote. All are novel, and some of the answers are surprising. Many of them will suggest generalisations.

The form and detail of the solutions show Professor Nahin’s pedagogic intentions. For instance, we are reminded how to sum a specific infinite geometric...