Pack up a penguin, journeys into the mathematics of area by Chris Pritchard, pp. 240, £19.00 (MA members £13.30), ISBN 978-1-91161-608-5, The Mathematical Association (2020)

This is a fascinating and beautiful book that reveals interesting and varied pieces of mathematics. It would be enjoyed by any teacher, needing no more underlying mathematics than a capable A-level student, and would also be enjoyed by such a student. Indeed, students interested in further maths-related study would benefit and, one hopes, even enjoy the material shared here.

The problems are captivating. They are clearly explained and discussed, using good diagrams to make the explanations as clear as possible, and they are likely to encourage readers to put the book down, pick up a pencil and piece of paper and attempt their own solutions before reading the author's versions.

The introduction sets the context for studying area, reminding us of recent controversies about the use of Wales as a unit of area, before sharing some seemingly simple area questions. Then the book heads off into six chapters, each with a different focus and each bringing much light and interest to the topics.

The first chapter looks at packing problems, starting with packing circles into a rectangle, and moving onto hexagonal, triagonal and square packing. We are introduced to Malfatti's problem from 1803 of packing three circles into a triangle. Finally, the packing problem is inverted and we are shown some of the mathematics behind social spacing.

The next chapter brings our attention back to Euclid, Archimedes, Cavalieri and Heron. There is much classical geometry which I'm aware I know little about, and this chapter simply and carefully explains and elucidates.

From here we are introduced to surface area. Some beautiful illustrations and explanations take us through the surface areas of cones, frustums and spheres, and then we consider some real-world applications, with a variety of different buildings from the Willis building in Chicago to the Due Torri in Bologna. From pyramids to oast houses—many different shapes are explained and exemplified.

Three chapters deal with more abstract ways of using area to explain and clarify topics in algebra, trigonometry, and series. The use of area to explain algebraic expansions is becoming more widespread and this chapter is an model of how this use can enhance our teaching of algebra. Many students find these visual explanations memorable, and our teaching would probably be improved by using this approach more frequently.

Finally, there are 55 problems (fortunately with full solutions) to enable readers to develop their own understanding much more fully. This is definitely one of those books where reading and nodding wisely is not sufficient, and we are by far the better off for having wrestled with the mathematics ourselves by taking an active role as problem solver, not just allowing the author to do all the work.

There is much to gain here on a number of levels. As a mathematician I am drawn to learn more and to solve the problems for myself, as a teacher I am drawn to use the techniques shared here to help me teach differently and to give me a wider variety of approaches, as an enthusiast for mathematics I am drawn to have this book on hand ready to loan. I am sure that mildly interested sixth formers would be involved, their interest deepened and their enthusiasm boosted by this volume. There are many fascinating books written for students, but few do such a good job at persuading the reader to want to try the mathematics for themselves.

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