



Noel-Ann Bradshaw

Thinking Mathematically

by J.Mason, L.Burton, K.Stacey. 2nd edition, 2010.

London: Pearson Education Ltd. ISBN 978-0-273-72891-7

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I was delighted and honoured to be asked to review this book as the previous edition profoundly influenced my learning and teaching of mathematics. I initially borrowed it from the library as a first year undergraduate during my Christmas vacation and was so amazed by it that I immediately gave a talk on the subject to our newly-formed mathematics society. The notion that 'being stuck is an honourable state' and the concept of 'specialisation' changed my way of working and had an immediate impact on my mathematical learning. Since then I have used this book as the basis for a first year undergraduate course and frequently refer to it when tutoring my mathematics students.

This is the second edition of *Thinking Mathematically*. The first was published in 1982 and revised in 1985. Whilst this edition has some additions and a few changes, fans will be pleased to know that the bulk of the text (including the problems and cartoons) remains the same. The most obvious change is that of the typesetting and formatting. Although this might seem to be purely cosmetic, I feel this has greatly enhanced the book's readability thus enabling it to reach a wider audience. For some of us, the name of John Mason may be enough to encourage us to read on, an accessible typeface, interesting cover and clear signposting is very important for today's undergraduates who may not readily take to the concept of reading a mathematics book for pleasure!

This edition comes with a new introduction providing greater insight into the ethos behind the book and the origins of the material. Polya's name occurs frequently and it is obvious reading this that his work has been a major source of inspiration for the authors' teaching of mathematics.

There is a new chapter containing extra problems specifically based on curriculum topics. Spanning the primary to undergraduate syllabuses it includes topics such as factors, primes, ratios, equations, functions, calculus etc. There are also links from each of these to relevant problems mentioned elsewhere in the book.

The questions in this new chapter are suitable to be used by teachers to encourage their students to think around the subject being taught. Some are ideal for stretching the brightest whilst others could be used for stimulating mathematical thought processes in the more typical. Either way, this is a welcome and useful addition. The final new chapter is described as a glossary of the mathematical terms and concepts used in the book. This details more of the theory and psychology behind the concepts of thinking mathematically (without illustrating them with

specific problems); an invaluable addition for understanding how our students learn to think and manipulate the mathematics we teach.

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What makes this book stand out in the vast array of readable mathematics books now available, is that it immediately gets the reader thinking and doing, rather than just reading. Each chapter is packed full of problems that you want to try straight away. Indeed, you have to try them to make sense of them and experience the point the authors are making. It’s a book that demands to be read with pencil and paper in hand. Although familiar with the text, I engaged with it even more whilst reading it again for this review. Several of the puzzles gripped me to the extent that my partner and I missed our bus whilst standing at the bus stop discussing and musing on the difference between squared numbers and I felt compelled to stop and make notes on another problem whilst in the middle of an exhibition at the National Gallery. Students should be warned that this is not a comfortable book to read, nor will it make you an easy person to be around while you are reading it - many of us are probably in that category already.

I would recommend this as an essential read for today’s mathematics undergraduates. We all complain that students do not seem to have the basics of algebra at their fingertips. Why is this? Maybe it is because algebra requires some thinking. It is not straightforward – one needs to get a feel of a problem before working out how to solve it algebraically – and this requires thinking. Students do not seem to be good at sketching a graph or diagram to help them visualise something, nor are they keen to jot down notes on what the question tells them. This book will show them why all this is necessary and essential for mathematical thinking. Rather than our students listening to us saying over and over again that a diagram would really help or asking why they haven’t at least written down what they know, the problems in this book will clearly demonstrate the importance of such things.

The main chapters take the reader through all the stages of mathematical thinking when problem solving, and what to do when you are stuck. They describe ways of specialising and generalising problems, how to enter,

attack and review what you are doing. The area I have found most useful for students is specialising. When they are going round and round in circles on a particularly hard problem, despairing that they can’t do calculus or algebra or mathematics in general, I encourage them to look at a similar simpler problem which I know they can solve, and then take one slightly harder and so on. Not only does this help with the problem they are struggling with but it teaches them a technique that they can use for themselves next time. Students seem to feel that if they are stuck they should give up. Reading this book will make them see that this is nonsense. It is only by working through a problem that they will learn the skills and techniques that employers find so desirable in mathematics graduates. I long for my students to realise that “being stuck is a healthy state, because you can learn from it... [you] relax, accept it, and enjoy it, for it a great opportunity to learn.”

So my advice to all those of you reading this review and involved in the teaching of mathematics is to make sure you read this book. If you already know it well, it is still worth reading this revised edition to ensure you are using it to influence your teaching. Above all, you should encourage your students to read it too.