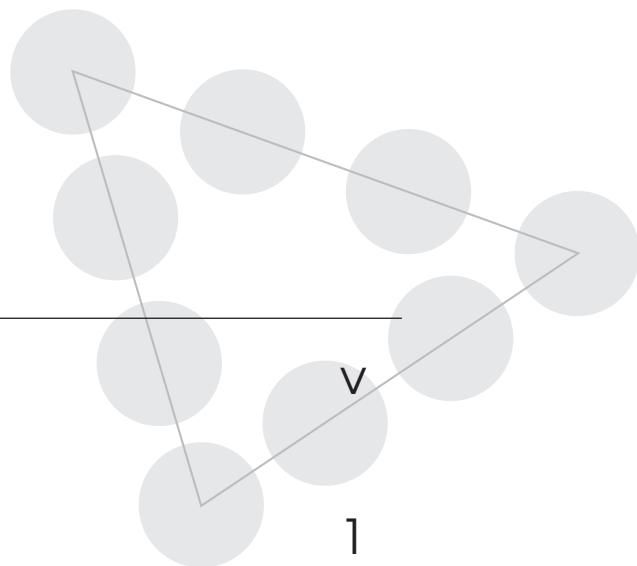


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Introduction

Stretch, Bend and Boggle is a book of logical and mathematical problems for all those who relish stimulation and challenge. It is particularly suitable for students at secondary school who have some experience in problem-solving techniques and cooperative-learning approaches, have a sound knowledge of basic numeration, and want something better than a monotonous diet of techniques and examples divorced from the real world.

The aim throughout is to provide material to develop process skills in mathematics, such as thinking, selecting strategies, teamwork, checking and reflecting.

Almost all of the problems can be solved by the mathematics studied by Year 7. None requires mathematical knowledge beyond a normal Year 10 syllabus.

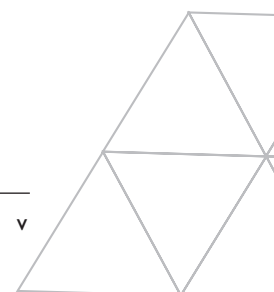
Rationale

When there is too heavy an emphasis on methods in mathematics, its inherently logical nature is often ignored; research has consistently shown that children's logical abilities are usually of a high order compared with their actual achievements in primary mathematics. Students have commonly reported on their wish for the stimulating challenges this book offers.

Thomas Edison truly said 'Genius is one per cent inspiration and ninety-nine per cent perspiration', and it is regrettably true in this age of instant everything that perseverance does not get its due credit. With most of these problems, there is no instant fix, and some sustained thought is required; 'If at first you don't succeed, try, try again.'

Ever since George Polya wrote his book *How to Solve It*¹, it has been increasingly realised that a few basic strategies are invaluable when trying to unravel a knotty problem. Most teachers and many students will by now be very familiar with some of these strategies, which include:

- guess and check
- work systematically
- use reasoning
- look for a pattern



-
- solve a simpler problem
 - make a chart or table
 - act it out
 - write down an equation
 - draw a diagram
 - make a model
 - work backwards
 - compare with a similar problem.

Suggested strategies for the Stretches problems are included in the answers.

A laudable development in mathematics education is the acknowledgement of the value of working together and discussion for problems with no obvious line of approach. Most of the problems in the book lend themselves to such cooperative activity. One aim has been to enable the problem to be posed in a very brief time; teachers may embellish if they wish.

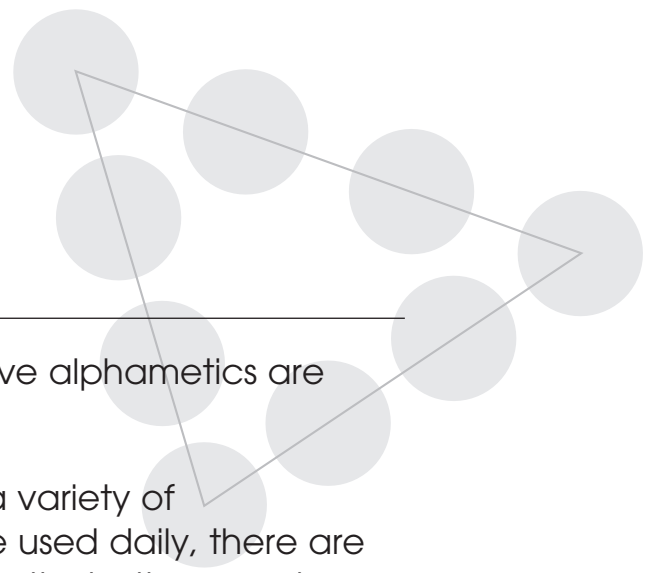
Structure of the book

Stretches are designed to be quickly stated, to have relatively straightforward answers and often to allow further investigation. In each set there is a mixture of problem types. For a class it is intended that problems should not take much more than ten minutes, including discussion time. They are particularly suitable as general motivators and warming-up exercises. The answers given are intended to be concise.

Benders will take longer and are very suitable for problem-solving by a group; in each of the ten sets there are problems on logic, algebra, geometry and number, and there is an alphametic. There is a hint for each problem as well as full answers and commentary.

Bogglers are longer and often harder even though they require no more mathematical knowledge. Again there is a hint for each question, and full answers with explanations are provided.

For those who are unsure how to go about solving logical problems, there are notes after the answers to Week 1, Problem 2



and Week 2, Problem 3; hints on how to solve alphametics are given in the note after Week 1, Problem 5.

The format is designed to lend itself to a variety of organisational patterns. If the Stretchers are used daily, there are more than enough for a school year; alternatively, they can be used to introduce a topic, to provide variety, to extend fast workers or to conclude a block of work. Alternative uses for Benders and Bogglers are as 'Problem of the week', as an ongoing project problem or for a mathematics competition. Teachers who wish to group Benders and Bogglers according to technique will find a summary in the Appendix.

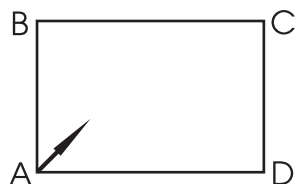
References

- ¹ G. Polya *How to Solve It. A New Aspect of Mathematical Method* (Princeton University Press 1971 2nd edition).



Week 1

1. A knockout competition attracts 75 entries, and a bye is used every time an odd number is left for a round. How many matches are played?
2. Betty sat at a square table with drivers of a bus, a van and a truck. She sat on Tania's left and Pat sat on the van driver's right. If Alison (who sat opposite Tania) is not the truck driver, who drives the bus?
3. 'Aba, Baba and Caba are joined by three straight roads. It is 3 km from Aba to Caba, 8 km from Baba to Aba and 4 km from Caba to Baba.' What is wrong with this statement?
4. Four mirrors form a rectangle 3 m by 2 m. A light beam is shone from A at 45 degrees. Which corner does the beam strike first?



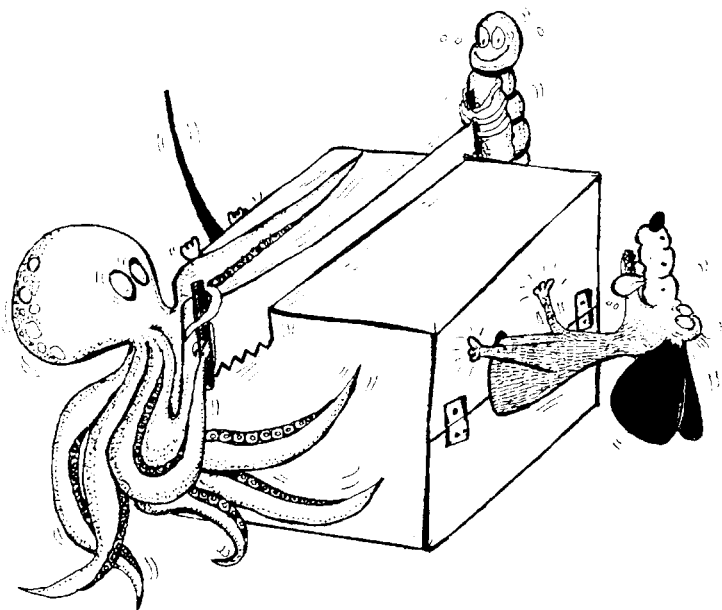
5. $3 \times \text{NEW} = \text{WINE}$. What digits do the letters represent?



Week 2

1. What day was 1 January 2004?
2. If $AA \times A = BB$ and $AA + A = AC$, what different digits do A, B and C stand for?
3. On the island of Koo there are two tribes, the Goodies who always tell the truth and the Fixers who always lie. You meet three people. If A says 'All of us are Fixers' and B says 'Just one of us is a Goodie', to which tribe do A, B and C belong?

4. How can you cut a cube with one straight cut to obtain an equilateral triangle?



5. If my three children have ages which add to 21 and multiply to 75, how old are they?

