

Key Stages 2 / 3
(Ages 11 - 13)

Brain Benders Book 3

Challenging Maths Problems
for Upper Primary and Lower
Secondary Students

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Teachers' Notes

What is this book about?

This book contains thirty-four photocopiable mathematical problems. The problems have been written and presented to suit a range of abilities and ways of thinking and learning in upper primary and lower secondary school. Problem solving is an important part of the mathematics curriculum and this book has been designed to help students become familiar with, and put into practice, a range of problem solving techniques. The strategies which this book encourages students to use and develop are: guess and check, looking for patterns, drawing pictures and modelling objects, listing and eliminating possibilities, filling in grids, using timelines and making assumptions and estimates and judging the reasonableness of them. The problems are also designed to highlight the importance of reading mathematical language carefully.

Why have we written this book?

We have both been school teachers and are aware of the kind of support materials that busy teachers need. Over the years, we have collected the mathematical problems that appear in this book, and have shared many of them with our peers. It is their promptings that have brought about the publishing of this collection. The problems that appear in this book will add flavour and interest to a mathematics programme. They will create discussion and debate and stimulate mathematical thought. It is our belief that children exposed to such problems as the ones in this book will develop greater powers to solve problems, investigate information and make decisions inside as well as outside of the classroom. Most of these problems do not have immediately obvious answers. Their solutions might well include group discussion, or time to think them over at school or at home.

What is different about this book?

In spite of the fact that the types of problems that we have published have existed for a long time, are enjoyed by children and are an integral part of the curriculum, it seems that not all teachers are using them. We think that one of the reasons for this is that they have not been made available in a 'ready-to-use' format. We have published this book in what we believe is a 'ready-to-use' format: using large print for creating overhead transparencies, mainly limiting one problem to one page, and providing answers which focus on the step-by-step methods which children are likely to use to solve the problems. We are aware that there are more sophisticated and sometimes shorter explanations of answers to some of the problems, but we have chosen to explain the answers in ways that we think children will best understand them.

How might you use this book?

Teachers can use these problems in a variety of ways. Some teachers have found it effective to give their students a problem at the end of a mathematics lesson as a starter discussion for the following day. Students are often sufficiently interested in the problems to discuss them at home. The most important thing for teachers to realise, is that if the problems are at the right level for their students, then they will not be solved immediately but will require some thought and possibly some discussion and debate. At the back of the book, there is a Brain Teaser section which consists of sixteen short mathematical problems, which can be solved quickly and used as warm ups to any lesson. In the middle of the book we have created a Brain Buster section which includes more difficult mathematical problems. You may use the problems which appear in this section as you wish. They could, for example, be used to extend more able students or to occupy fast finishers.

We hope that you and your students enjoy solving these problems.

Barry Brocas and Brenda Bicknell

Curriculum Links

Mathematics - Key Stage 2

Ma2 Number and Algebra

Using and Applying Number: problem solving, communicating, reasoning.

Numbers and the Number System: counting, number patterns and sequences, fractions, percentages and ratio.

Calculations: number operations and the relationships between them, mental methods, written methods.

Solving Numerical Problems.

Ma3 Shape, Space and Measures

Using and Applying Shape, Space and Measures: problem solving, communicating.

Understanding Properties of Position and Movement.

Understanding Measures.

Ma4 Handling Data

Using and Applying Handling Data: problem solving, communicating, reasoning.

Processing, Representing and Interpreting Data.

Mathematics - Key Stage 3

Attainment Targets

Using and Applying Mathematics

Number and Algebra

Shape, Space and Measures

Statistics

Key Processes

Representing

Analysing

Interpreting and Evaluating

Communicating and Reflecting

Key Concepts

Competence

Creativity

Applications and Implications of Mathematics

Critical Understanding

Range and Content

Geometry and Measures

Statistics

Ellie and Edgar

Two tribes live on an island. Members of one tribe always tell the truth and members of the other tribe always lie. You meet two islanders named Ellie and Edgar.

Ellie says, "We are from different tribes." Edgar says, "Ellie is from the tribe of liars."

Which tribe is Ellie from?

Which tribe is Edgar from?



Ellie is from the tribe
who _____

Edgar is from the tribe
who _____

Hint: Use a guess and check approach to solve this problem. Assume that Ellie is lying, then check your assumption, if it does not make sense, make another assumption to check.

Answer ►

Ellie and Edgar

✓ *Students should make assumptions and check their accuracy.*

The four possibilities are:

	Ellie	Edgar
Possibility 1	T	T
Possibility 2	T	F
Possibility 3	F	T
Possibility 4	F	F

- The first is not possible because Ellie would be lying.
- The second is possible because Ellie would be telling the truth.
- The third is not possible because Ellie would be telling the truth.
- The fourth is possible because Ellie would be lying.
- Either way, Edgar is a liar.

So Edgar will be lying when he says that Ellie is a liar. So Ellie is a truth teller. **So the answer is: Ellie is from the tribe who tell the truth and Edgar is from the tribe who lie.**



Ellie is from the tribe
who tells the truth

Edgar is from the
tribe who lies

Brain Teasers

Sample

Sample

Sample

Brain Teaser 1

Just a Symbol

What arithmetic symbol can be placed between two and three to make a number greater than two but less than three?



Brain Teaser 2

Adding Weight

What can you put in a box that weighs nine kilograms to make it weigh eight kilograms?



Brain Teaser 3

What is it?

A half is a third of it.
What is it?



Brain Teaser 4

Cakes

A girl had seven cakes and ate all but three. How many were left?

