



**Ebook Code:  
REUK0070**



**Key Stage 2  
(Ages 7 - 9)**

# **B**rain **B**enders **B**ook 1

**Challenging Maths Problems  
for Primary Students**

**BY BARRY BROCAS AND**

**BRENDA BICKNELL**

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# Teachers' Notes

## **What is this book about?**

This book contains twenty-six photocopiable mathematical problems. The problems have been written and presented to suit a range of abilities and ways of thinking and learning in junior primary 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 primary 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.

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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 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.  
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.

### Ma4 Handling Data

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

Sample  
Sample  
Sample

**Brain Bender 1**

How do you rate this Brain Bender?

- Brain Boring!  Easy on the Brain!  Brain Bending!  Super Dooper Brain Bending!

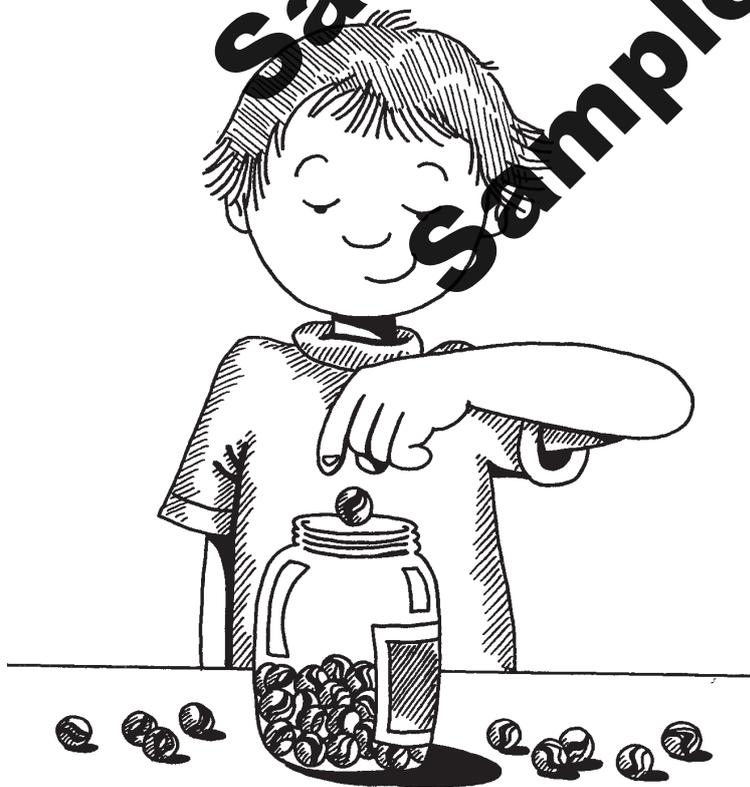
# Marbles in a Jar

On Monday, Troy put one marble in a jar. Each day after that, he doubled the number of marbles in the jar. After six days, the jar was full of marbles.

**How many days did it take before the jar was half-full of marbles?**

Monday      Tuesday      Wednesday      Thursday      Friday      Saturday

\_\_\_\_\_ days



Answer ►

## Marbles in a Jar

If the jar was full after six days, then it must have been half-full the previous day, because each day Troy doubled the number of marbles that he placed in the jar.

**So the answer is five days.**

**Sample**

**Sample**

**Sample**



# Name the Pets

Four pets are kept in cages in a back yard as shown below.

There is a rabbit, a hen, a guinea pig and a rooster.

Their names are Chip, Tommy, Dale and Mickey.

**Use the clues below to match the names to the pets.**

**Clue 1** The guinea pig is next to the hen and the rooster.

**Clue 2** Dale is opposite the guinea pig.

**Clue 3** The hen is called Chip.

**Clue 4** Mickey is opposite the hen.

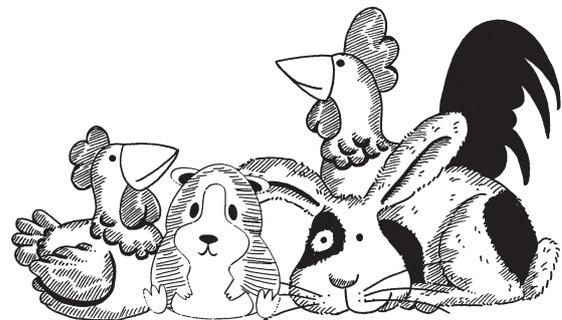


Rabbit

Hen

Guinea Pig

Rooster



Answer ▶

# Name the Pets

The clues lead to the following deductions:

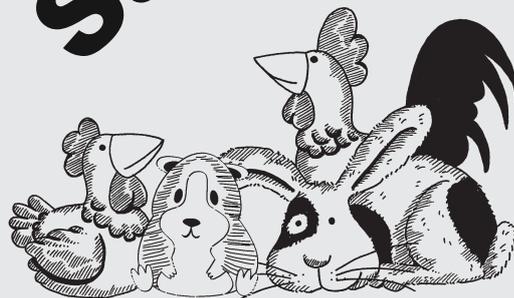
The first clue tells us that the rabbit must be opposite the guinea pig, so the rabbit's name is Dale (the second clue).

The hen and the rooster must be opposite each other (the first clue), so the rooster's name is Mickey. We can tell this from the fourth clue.

We are told that the hen's name is Chip (the third clue), so the guinea pig's name must be Tommy.

**So the answer is:**

Rabbit	Dale
Hen	Chip
Guinea Pig	Tommy
Rooster	Mickey





**Ebook Code:  
REUK0071**



**Key Stage 2  
(Ages 9 -11)**

# **B**rain **B**enders **B**ook 2

**Challenging Maths Problems  
for Primary Students**

**BY BARRY BROCAS AND**

**BRENDA BICKNELL**

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# Teachers' Notes

## **What is this book about?**

This book contains twenty-eight photocopiable mathematical problems. The problems have been written and presented to suit a range of abilities and ways of thinking and learning in middle primary 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?**

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*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.

Sample  
Sample  
Sample

**Brain Bender 1**

How do you rate this Brain Bender?

- Brain Boring!  Easy on the Brain!  Brain Bending!  Super Dooper Brain Bending!

# The Jellybeans

Ainsleigh ate one hundred jellybeans in five days.  
Each day she ate six more than she ate the previous day.

**How many jellybeans did Ainsleigh eat on the first day?**



\_\_\_\_\_ jellybeans

Hint: Use a guess and check approach. Guess how many she ate on the first day and adjust guesses accordingly.

**Brain Bender 2**

How do you rate this Brain Bender?

- Brain Boring!  Easy on the Brain!  Brain Bending!  Super Dooper Brain Bending!

# The Eggs

If three hens will lay three eggs in three days, how many eggs will six hens lay in six days?



\_\_\_\_\_ eggs

## Brain Bender 1

Answer ▶

### The Jellybeans

✓ *Students should use a guess and check approach.*

One possible approach is to have a guess and adjust the figures until all five days total a hundred. For example, if a student guesses that Ainsleigh ate one jellybean on the first day, they will be thirty-five jellybeans short:

$$1 + 7 + 13 + 19 + 25 = 65$$

This is an average of seven jellybeans short each day. So seven should be added to each number to get:

$$8 + 14 + 20 + 26 + 32 = 100$$

**So the answer is: Ainsleigh ate eight jellybeans on the first day.**

Some more able students may be able to understand, if taught, that the middle number has to be the average of the five numbers, because the difference between consecutive numbers is constant. So the middle number must be twenty. It is then easy to reach the answer.

## Brain Bender 2

Answer ▶

### The Eggs

✓ *Students use computation to solve this problem.*

If only the number of hens doubled and the number of days remained the same, the answer would be six eggs – double the number of eggs.

But the six hens also have twice as much laying time.

**So the answer is 12 eggs.**



**Brain Bender 3**

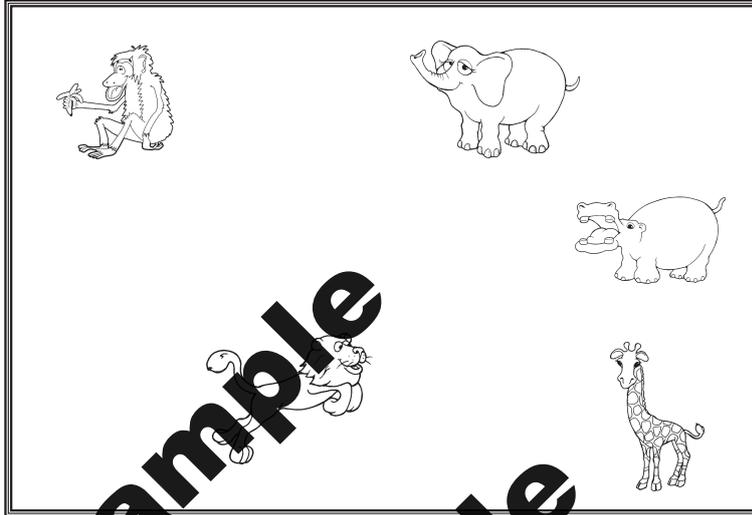
How do you rate this Brain Bender?

- Brain Boring!  Easy on the Brain!  Brain Bending!  Super Dooper Brain Bending!

## Animals in the Zoo

A small zoo has enough fencing to surround five animals but not enough to separate them. However, by digging three straight trenches, (drawing three straight lines on the diagram below) the animals can be separated from each other. The animals cannot move from their places as shown below.

**Where could the trenches (lines) be placed?**



Hint: There are many possible solutions to this problem.

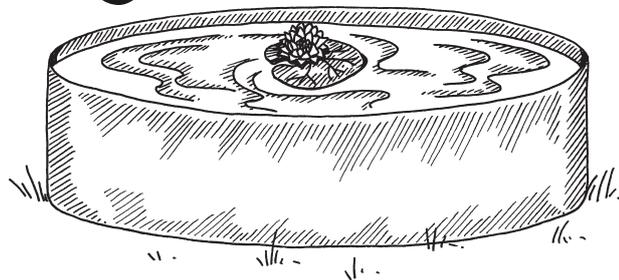
**Brain Bender 4**

How do you rate this Brain Bender?

- Brain Boring!  Easy on the Brain!  Brain Bending!  Super Dooper Brain Bending!

## The Lily Pond

A water lily on a pond doubles in size each week. It takes ten weeks to cover the whole pond, how many weeks would it take to cover half the pond?



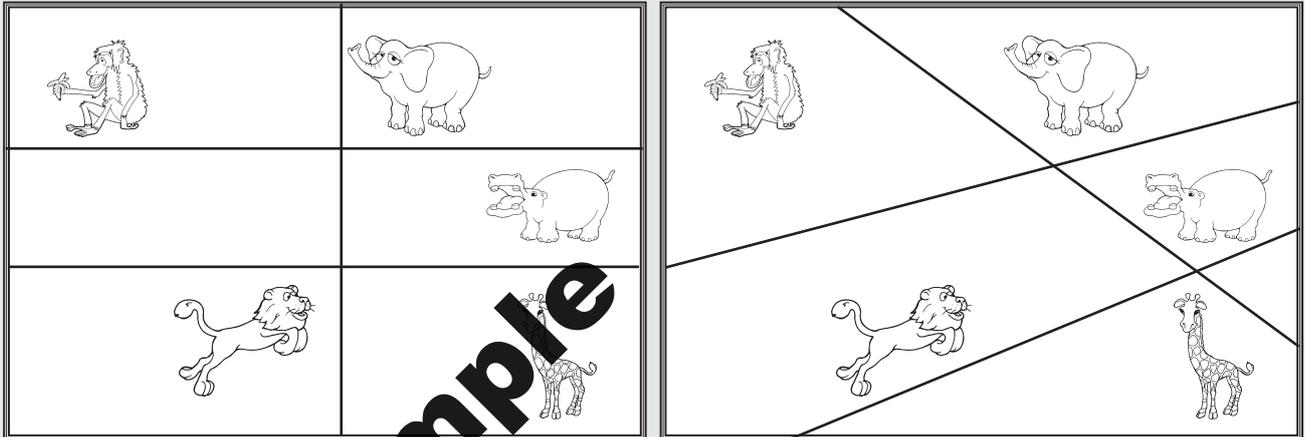
\_\_\_\_\_ weeks

### Brain Bender 3

Answer ▶

### Animals in the Zoo

- ✓ Students will arrive at a solution through trial and error.
- ✓ There are many solutions. Two possibilities are shown below.



Sample  
Sample  
Sample

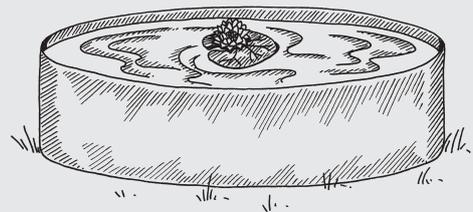
### Brain Bender 4

Answer ▶

### The Lily Pond

- ✓ Students work backwards to solve this problem.

Since the water lily doubles in size every week and it covers the whole pond after ten weeks, it must have covered half of the pond after nine weeks.





**Ebook Code:  
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**Key Stages 2 / 3  
(Ages 11 - 13)**

# **B**rain **B**enders **B**ook 3

**Challenging Maths Problems  
for Upper Primary and Lower  
Secondary Students**

**BY BARRY BROCAS AND**

**BRENDA BICKNELL**

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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.

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# Curriculum Links

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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?**

Sample  
Sample  
Sample

We are from different tribes



Ellie is from the tribe of liars



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:

	<b>Ellie</b>	<b>Edgar</b>
<i>Possibility 1</i>	T	T
<i>Possibility 2</i>	T	F
<i>Possibility 3</i>	F	T
<i>Possibility 4</i>	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 answers: 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?

